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(B. DUNSTAN, CHIEF GOVERNMENT GEOLOGIST.)

PUBLICATION No. 257.

Mesozoic Floras of Queensland

Part I.—continued.

The Flora of the Ipswich and Walloon Series.

(c.) Filicales, Etc.

By A. B. WALKOM, B.Sc.,

Assistant Lecturer in Geology, The University of Queensland,
Honorary Palæontologist to the Queensland Museum.

WITH 10 PLATES AND 12 TEXT-FIGURES.

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CORRIGENDA.

Publication 252 (Mesozoic Floras of Queensland, Part I.).

P. 29, line 7, *for* Liassic *read* Middle Jurassic.

P. 29, line 20, *for Equisetites* (*?*) *laxum, read Equisetites* (*?*) *latum.*

P. 37, in table, *for E. columnaris* (Europe) .. Liassic, *read E. columnaris* (Europe) .. M. Jurassic.

P. 46, Plate 3, line 5, *for* fig. 6, *read* fig. 3.

AUTHOR'S PREFACE.

THIS paper is a continuation of the study of the Mesozoic Floras of Queensland, the first part of which appeared as Publication 252 of the Queensland Geological Survey. The present contribution comprises the description of the ferns and genera whose systematic position is uncertain, from the Ipswich and Walloon Series. The remainder of the flora of these Series will form the subject of a third paper.

Any general discussion of the relations of the flora to that of other parts of the world is postponed until the examination of the whole flora has been completed.

My thanks are due to Messrs. J. F. Bailey and C. T. White, of the Botanic Gardens, Brisbane, for their kindness in allowing me to examine specimens of recent ferns in the Herbarium; also to Messrs. W. R. Browne, B.Sc., R. H. Cambage, and W. S. Dun, through whose kindness I have been able to obtain the loan of literature, not available in Brisbane, from various libraries in Sydney. To Dr. R. Hamlyn Harris, Director of the Queensland Museum, I am indebted for the loan of two specimens of Phlebopteris alethopteroides and for permission to figure them.

Mr. B. Dunstan, Chief Government Geologist, has continued to give every possible assistance towards the carrying out of this work. I must also once more express my gratitude to Professor Seward for the interest he has taken in my work, and for the encouragement which I have received from him.

Brisbane, 22/1/1917.

CONTENTS.

Page.

LIST OF TEXT FIGURES. .. .. viii.

FILICALES.

? OSMUNDACEÆ

Cladophlebis 1

C. australis (Morris) 3

C. Roylei, Arber 5

CYATHEACEÆ—

Coniopteris delicatula (Shirley) 6

? MATONINEÆ—

Phlebopteris alethopteroides, Etheridge Jr. 8

DIPTERIDINÆ—

Dictyophyllum 9

D. rugosum, L. & H. 9

D. Davidi, Walkom 10

Hausmannia Buchii (Andræ) 11

THINNFELDIEÆ—

Thinnfeldia 12

T. Feistmanteli, Johnston 17

T. odontopteroides (Morris) 19

T. lancifolia (Morris) 21

T. acuta, Walkom 23

? MARATTIACEÆ—

Dancæopsis Hughesi, Feistmantel 24

HYDROPTERIDEÆ (?)—

Sagenopteris rhoifolia (Presl.) 25

GENERA OF FERNS AND PLANTÆ INCERTÆ SEDIS—

Sphenopteris 26

S. lacunosa, Shirley 26

S. superba, Shirley 27

S. Baileyana, Tenison-Woods 28

Tæniopteris 29

T. spatulata, McClelland 30

T. spatulata var. *major*, Seward 32

T. Tenison-Woodsi, Etheridge Jr. 32

T. Carruthersi, Tenison-Woods 34

T. lentriculiforme (Etheridge Jr.) 35

T. Dunstani, Walkom 37

T. wianamattæ (Feistmantel) 38

T. crassinervis (Feistmantel) 39

Stenopteris elongata (Carruthers) 40

Phyllopteris Feistmanteli, Etheridge Jr. 42

Lygodium antiquorum, Shirley 43

Pecopteris cf. *Mantelli* 43

Neuropteris punctata, Shirley 43

BIBLIOGRAPHY 44

EXPLANATION OF PLATES 47

LIST OF TEXT-FIGURES.

The majority of the drawings for the text-figures were made by my wife.

		Page.
1.	*Cladophlebis australis* (Morris)	4
2.	*Cladophlebis Roylei*, Arber	6
3.	*Coniopteris delicatula* (Shirley)	7
4.	*Hausmannia* (?) *Buchii* (Andrae)	11
5.	*Thinnfeldia Feistmanteli*, Johnston	18
6.	Cuticle of *Thinnfeldia lancifolia* (Morris)	22
7.	*Sagenopteris rhoifolia* (Presl)	25
8.	*Sphenopteris lacunosa*, Shirley	26
9.	*Tæniopteris Tenison-Woodsi*, Etheridge Jr.	33
10.	*Tæniopteris Carruthersi*, Tenison-Woods	35
11.	*Tæniopteris lentriculiforme* (Etheridge Jr.)	36
12.	*Phyllopteris Feistmanteli* (Etheridge Jr.)	42

THE FLORA OF THE IPSWICH AND WALLOON SERIES—continued.

By A. B. Walkom, B.Sc.

DESCRIPTION OF SPECIMENS.

FILICALES.

? OSMUNDACEÆ.

CLADOPHLEBIS.

The determination of the great number and variety of sterile fern fronds referred to the genus *Cladophlebis*[1] is an unsatisfactory task and has been frequently discussed at length. Professor Seward[2] has given an account of the genus and a summary of the distinguishing characters of the commoner species, and nothing is to be gained by going into the subject in great detail here.

In these sterile examples specific determination must be based on characters such as the form of the pinnules, venation, etc.; these characters are subject to a great deal of variation in recent ferns, and this fact must be borne in mind when dealing with the fossils.

Sterile examples of the *Cladophlebis* type are very common throughout the Lower Mesozoic rocks of Eastern Australia, having been most commonly known under the name *Alethopteris australis*, which name has more recently given place to *Cladophlebis australis*.

The relations of these fronds have been discussed in detail by Etheridge[3] and Seward[4]. The species *Cladophlebis australis* (*Alethopteris australis* of many early authors) is very similar to the common European species *C. denticulata* and has at times been identified with that species. It seems, however, to be a somewhat distinct type and is retained as a distinct species by Halle since it differs from *C. denticulata* "in regard to the shape of the pinnules, which have more parallel margins, taper more abruptly at the apex, which is more obtuse, and are only slightly or not at all falcate." [5]

---

[1] *See* Seward (10), (12), (00), and others.
[2] Seward (12), p. 15.
[3] Etheridge (92), p. 316.
[4] Seward (04), p. 171.
[5] Halle (13), p. 26.

Seward[6], in describing some examples of this species from Victoria, classes them as *C. denticulata* var. *australis*, indicating that they represent a somewhat distinct form of the *denticulata* type.

Examination of a large number of sterile fronds of this type from Queensland shows that it would be a matter of considerable difficulty to define adequately more than a single species. There is a considerable variation in the shape of the pinnules and also in the secondary veins. The latter sometimes bifurcate once, sometimes twice, before reaching the margin, but it is quite common to find both conditions in the same pinnule, hence no separation can be based on this character. I have therefore deemed it best to include all the Queensland fronds of the *C. denticulata* type under the single species *C. australis*.

Fertile specimens are unfortunately rare; but those which have been described in association with *Cladophlebis* indicate that this genus includes representatives of more than one family.

Fertile examples have been described in the case of *C. denticulata*, and this species is usually included in the Osmundaceæ although the evidence is not conclusive[7]. Some of these have recently been described by Halle,[8] who has instituted the generic name *Cladotheca* for them. He considers that the sporangia show "a closer relationship to the Marattiaceæ than to any of the leptosporangiate families."[9] Seward, however, believes that the relation of these sporangia to the Osmundaceæ is much closer than Halle supposes and retains fertile specimens of the *C. denticulata* type in the family Osmundaceæ.[10]

A fertile frond associated with *Cladophlebis australis* has been described from New South Wales by Renault as *Todea australis*.[11] It has linear sori parallel to the secondary veins, and the sporangia are globular-elliptical in shape and have a subapical group of thick-walled cells similar to recent Osmundaceæ. Shirley[12] records this species from Denmark Hill, Ipswich, but I have seen no fertile specimens resembling in any way those figured by Renault.

Shirley has also described and figured some specimens as *Scolecopteris australis*,[13] but these do not show sufficient evidence for placing them in this genus. They show the distribution and general nature of the sori but no details of the structure are preserved. I am not quite clear as to his interpretation of the specimens. In his Plate 12, the uppermost figure, which he refers

---

[6] Seward (04), p. 171.
[7] Seward (10), p. 343; (04), p. 171.
[8] Halle (11).
[9] Halle (11), p. 8.
[10] Seward (12), p. 15.
[11] Renault (83), p. 81, t. 11.
[12] Shirley (98), p. 18.
[13] Shirley (98), p. 17, t. 12.

to as "under side," is an impression (mould) of the lower surface of a fertile frond. The middle figure, which he refers to as "lower side," is a cast of the lower surface. The last part of his description says, "upper surface showing two rows of mammillary markings indicating the sori; lower surface showing two rows of sori, each sorus appearing as a minute cross under the lens."[14] What he describes as the lower surface is the impression of the lower surface of the fertile frond, and the minute cross referred to is produced by the impression of the lines along which the sporangia are in contact. This is further shown in the case where the sorus consists of five sporangia, by the presence of five short radiating lines in the impression instead of four.

Zeiller has identified *Scolecopteris australis*, Shirley, with *Pecopteris Cottoni*, a species he described in 1903.[15] Unfortunately I have not, up to the present, been able to see the plates of Zeiller's work. He remarks that "it seems evident that we have to do with fructifications of the type of *Asterotheca* with sessile synangium and ovoid sporangia and not with the *Scolecopteris* type. . ." This certainly seems to be the case, and the specimens have a general resemblance to the *Asterotheca* type of fertile frond. The Australian species does not altogether agree with Zeiller's description of *Pecopteris Cottoni*, and should be referred to *Cladophlebis* rather than to *Pecopteris*.

Cladophlebis australis (Morris.)

(Plate 5, figs. 1, 2(*a*); Plate 7, fig, 1; Plate 8, fig. 1; Text-fig. 1.)

(For full synonymy *see* Seward (04), p. 171.)

1845. *Pecopteris australis*, Morris, Strzolecki's Phys. Desc. N.S.W. and Van Diemen's Land, p. 248, t. 7, fig. 1, 2.

1883. *Alethopteris australis*, Tenison-Woods, P.L.S. N.S.W., 8, p. 111.

1883. *Alethopteris concinna*, ibid., p. 112, t. 9, fig. 1.

1890. *Alethopteris australis*, Feistmantel, Mem. Geol. Surv. N.S.W., Pal. 3, p. 109, t. 27, fig. 3, 3a.

1890. *Alethopteris concinna*, ibid., p. 110.

1892. *Alethopteris australis*, Etheridge Jr., Geol. Pal. Qland., pp. 316, 370.

1898. *Todea australis*, Shirley, Qland. Geol. Surv., Bull. 7, p. 17.

1898. *Scolecopteris australis*, ibid., p. 17, t. 12.

1902. *Todea australis*, Shirley, Qland. Geol. Surv., Bull. 18, p. 10.

Frond bipinnate, pinnæ oblique. The pinnules are slightly falcate or straight, attached by the whole base and decurrent;

[14] Op. cit., p. 17.

[15] Zeiller (03), p. 26.

apex generally rather acute. Well-defined midrib, usually persisting to apex; secondary veins make an acute angle with the midrib and bifurcate once or twice before reaching the margin; the margin is entire or slightly serrate. Fertile fronds have the pinnules somewhat narrower and inclined to be straighter than the sterile. Sori in two rows parallel to the midrib; the sori are close together and occupy nearly the whole of the under surface; each one is composed of four (rarely five) sporangia.

The only fertile pinnules associated with fronds of *Cladophlebis* among the Queensland collections are those described by Shirley as *Scolecopteris australis*.[16] There is not sufficient evidence to refer these specimens to the genus *Scolecopteris*. They are preserved as casts and impressions showing the general nature of the sori but no details of the structure have been preserved, hence the impossibility of referring them to their proper place.

In view of the fertile specimen associated with *C. australis* described from New South Wales by Renault as *Todea australis* there must remain a little doubt whether the specimens discussed here are the only fertile ones associated with the Queensland examples of *C. australis*. The shape of the pinnule in Renault's specimen is practically the same in both sterile and fertile fronds. In these Queensland examples there is a tendency for the pinnules in the fertile frond to be straighter and narrower than in the sterile. I have no doubt that the fertile specimens described belong to the *C. australis* type of frond; whether they are the only type of fertile frond associated with the *C. australis* type of foliage is uncertain.

The sori are numerous and close together, being arranged in two rows, one on either side of the midrib. They are so close together

TEXT-FIGURE 1.

Cladophlebis australis (Morris). Portion of a frond in which the lower pinnules only are fertile (Nat. size.)

that they practically cover the lower surface of the pinnule and call to mind the *Asterotheca* type of fertile pinnule as noted by Zeiller.[17]

[16] Shirley (98), p. 17.

[17] Zeiller (03), p. 28.

The sori are inclined to be rectangular in outline with rounded corners, and each is made up of four (occasionally five) sporangia. The sporangia are apparently in close contact, and in the mould of the lower surface of the pinnules a cross of fine lines represents the lines of contact of the sporangia. There are usually about twenty sori to a pinnule, the range of variation noticed being from eighteen to twenty-four on a single pinnule. No trace of the cell structure has been observed.

In some specimens (*e.g.* text-fig. 1) the lower pinnules are fertile and the upper sterile.

Localities :—(*Ipswich Series*) : Bundamba (New Chum) (F 205) ; Ebbw Vale Colliery (F 205) ; Ipswich (F 206) ; Yeronga (F 219). (*Walloon Series*) : Brovinia (55 miles N.N.E. of Chinchilla) (F 603) ; Beaudesert (F 197) ; Clifton Colliery (F 204) ; Colinton (F 209) ; Chinchilla (Por. 146, Par. Colamba) (F 187) ; Cressbrook (F 211) ; Fassifern (F 204) ; Gunalda (F 183) ; Kilcoy (F 212) ; Killarney (F 210) ; Nixon's Selection, Nerang Creek (F 207) ; Por. 98, Par. Beaudesert (F 202) ; Por. 28, Par. Biarra (F 223) ; Por. 33, Par. Esk (F 225) ; Stanfield's Selection, Beaudesert (F 523) ; Stewart's Ck. (F 186) ; Templin, near Kalbar (F 748).

Fertile specimens have been obtained from Denmark Hill, Ipswich (F 217), and Toombul Quarry, Nundah (F 201). (*Ipswich Series.*)

Figured Specimens : The originals of Plate 5, figs. 1, 2A, Plate 7, fig. 1 and Plate 8, fig. 1, are specimens F 219, F 445, F 215, and F 217 respectively in the Queensland Geological Survey Collection. *Text-figure* 1 is drawn from specimen F 732 in the same collection.

Cladophlebis Roylei, Arber.

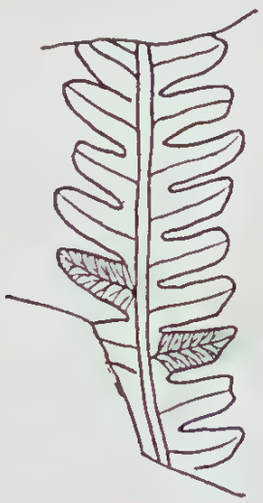
(= *Alethopteris Lindleyana*, Royle.)

Text-fig. 2.

1901. *Cladophlebis Roylei*, Arber, Geol. Mag., Dec. 4, 8, p. 548.
1892. *Alethopteris Lindleyana*, Etheridge Jr., Geol. Pal. Qland., p. 370, t. 17, fig. 3, 4.
1898. *? Alethopteris Lindleyana*, Shirley, Qland. Geol. Surv., Bull. 7, p. 20, t. 13, fig. 1.

The species *Cladophlebis Roylei* is one which is distinct from *C. australis*, and the specimen figured by Etheridge from Redbank, near Mt. Esk, may be referred to it. The pinna is more compact than in *C. australis*, the pinnules are more at right angles to the

rachis, and are shorter, straighter, and more obtuse. The pinnules are attached by the whole of the base. The midrib is strong, and the secondary veins bifurcate once.



TEXT-FIGURE 2.
Cladophlebis Roylei, Arber. (Nat. size.)

The specimen figured by Shirley as *A. Lindleyana* is not a well-preserved one, and it is doubtful whether it belongs to this species.

Localities :—(*Ipswich Series*) : Denmark Hill, Ipswich (F 188) ; Yeronga (locality given by Shirley). (*Walloon Series*) : Por. 94, Par. Logan (F 185) ; Redbank, near Mt. Esk (F 218).

Text-figure 2 is drawn from specimen F 218 in the Queensland Geological Survey Collection.

CYATHEACEÆ.

CONIOPTERIS DELICATULA (Shirley).

(Plate 4, fig. 2 ; Plate 10, fig. 2 ; Text-fig. 3.)

1898. *Sphenopteris delicatula*, Shirley, Qland. Geol. Surv., Bull. 7, p. 18, t. 10, fig. 1.

1898. *Triphyllopteris botryoides, ibid.*, p. 20, t. 17, fig. 1.

Frond tripinnate ; pinnæ alternate, making acute angle (about 30°) with the rachis ; pinnules opposite, fairly constant in shape, usually having three linear, rather acute lobes with one vein going to each lobe. Venation of the *Sphenopteris* type.

In fertile pinnules the lamina is much reduced and bears a number of fairly large spherical sporangia.

The two species which I have united here were described and figured by Shirley.[18] The figure given by him of *Sphenopteris deli-*

[18] Shirley (98), pp. 18, 20.

catula does not resemble in the least the specimen from which it was drawn (F 273). On Plate 17, fig. 1, under the name *Triphyllopteris botryoides*, the same author figured three fragments (one sterile and two fertile). The left-hand figure (sterile fragment) is portion of a frond exactly similar to his type specimen of *S. delicatula*. Two of the specimens are refigured here (Plate 4, fig. 2, and Plate 10, fig. 2.)

Only about a dozen specimens have been obtained from the locality where these specimens were obtained, and the only recognisable remains are the sterile and fertile fragments joined under this species, so there seems little doubt that they belong to the same plant. The fertile specimens are interesting, but unfortunately there is practically no trace of the structure of the sporangia. In

TEXT-FIGURE 3.

Coniopteris delicatula (Shirley). Portion of a fertile frond. (x 6.)

one or two sporangia a few cells can be seen, but not enough to be of use. The sporangia are comparatively large, spherical, and clustered in groups. At first sight these groups of sporangia recall the modified fertile pinnæ of *Osmunda regalis*, but closer examination shows in some cases the remains of a much reduced lamina. Each group contains a number of sporangia (up to 45 having been observed in a single group).

There is similarity in a general way between these specimens and figures of *Coniopteris quinqueloba* (Phillips),[19] though the latter species is somewhat smaller. There is a fairly close resemblance between the sterile fronds of *C. delicatula* and *C. hymenophylloides*.

These specimens have been referred to the genus *Coniopteris* on account of the close similarity of the sterile fronds with those of species of *Coniopteris*, together with the occurrence of the sporangia, more or less spherical, grouped in masses on a much reduced lamina after the manner of *C. quinqueloba*.

[19] Seward (10), p. 370, fig. 273.

Locality :—(*Ipswich Series*) : Shorncliffe, Sandgate (F 251).

Figured Specimens: The originals of Plate 4, fig. 2, and Plate 10, fig. 2, are specimens F 231 and F 273, respectively, in the Queensland Geological Survey Collection. Text-figure 3 is drawn from specimen F 231.

? MATONINEÆ.

Phlebopteris alethopteroides, Etheridge Jr.

(Plate 9, fig. 2; Plate 10, fig. 1.)

1888. *Phlebopteris alethopteroides*, Etheridge Jr., P.L.S. N.S.W., 3, p. 1306, t. 38, fig. 1, 2.

1889. *Phlebopteris alethopteroides, ibid*, vol. 4, p. 625.

1892. *Phlebopteris alethopteroides*, Etheridge Jr., Geol. Pal. Qland., p. 378.

"Pinnæ large, probably elongate. Rachis strong, moderately thick or wide, and longitudinally grooved and ridged. Pinnules lingual, strap-shaped, narrow, very long, parallel-sided, alternate, sub-alternate or opposite, very regular in appearance and equidistant, markedly confluent. Midrib strong, tapering gradually, and extending to the apices of the pinnules; reticulation small, consisting of elongate, rather irregular scale-like vesicles; veins almost at right angles to the midrib, bifurcating immediately after leaving the reticulation." (*Etheridge.*)

Etheridge[20] has described both sterile and fertile examples of this species. He compared it with *Phlebopteris affinis*, Schenk, and the fertile specimens with *P. polypodioides*. The latter species is now identified with *Laccopteris polypodioides*, belonging to the family Matonineæ.

Seward[21] has also compared this species with *Laccopteris polypodioides*. The venation of *P. alethopteroides* seems to be distinct from that of *L. polypodioides*. Only a couple of sterile fronds are available, so it is not possible to discuss the systematic position of this species. It is therefore only doubtfully indicated as belonging to the Matonineæ.

Locality :—(*Walloon Series*) : Darling Downs, near Toowoomba (F 695), Fassifern (Queensland Museum Specimen 17/1277).

Figured Specimens: The originals of Plate 9, fig. 2, and Plate 10, fig. 1, are specimens 17/1277 and 17/1278, respectively, in the Queensland Museum Collection.

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[20] Etheridge (88), (89).

[21] Seward (00), p. 42.

DIPTERIDINÆ.

Remains of ferns belonging to this family are not uncommon on certain horizons of the Lower Mesozoic Rocks, viz., in the Ipswich Series at Denmark Hill, Ipswich, and in the Walloon Series in the Esk district.

The majority of them are referred to *Dictyophyllum*, and a couple of specimens doubtfully to *Hausmannia*.

DICTYOPHYLLUM.

Two species are described here under the names *D. rugosum*, L. and H., and *D. Davidi*, n. sp. The two are distinct from one another in several characters and they come from different horizons. *D. rugosum* occurs in the Ipswich Series at Denmark Hill and *D. Davidi* in the Walloon Series near Esk ; it is just possible also that some imperfect specimens from the latter locality should be referred to *D. rugosum*, but I think at present that they are more probably *D. Davidi*. A few fertile specimens of *D. rugosum* are in the University of Queensland collections, but details of the sporangia are not preserved.

Dictyophyllum rugosum, L. and H.

(Plate 4, fig. 3 ; Plate 6, fig. 4(*b*) ; Plate 9, fig. 3.)

1834. *Dictyophyllum rugosum*, Lindley and Hutton, Fossil Flora, ii., t. 104.

1898. *Dictyophyllum bremerense*, Shirley, Qland. Geol. Surv., Bull. 7, p. 25, t. 13, fig. 2.

1900. *Dictyophyllum rugosum*, Seward, Jurassic Flora, 1, p. 122, t. 13, fig. 3 ; t. 18, fig. 1 ; text-figs. 17-19.

No complete fronds have been found among the Queensland specimens referred to this species, the available material consisting of portions of pinnæ. These cannot well be separated from the European species *D. rugosum*. Shirley[22] described some fragments from Ipswich as *D. bremerense*, but, as pointed out by Seward,[23] they may be compared with *D. rugosum*.

The pinnæ attain a breadth of as much as $2\frac{1}{2}$ in. and are deeply divided into a number of narrow lobes. The lobes extend about half-way to the midvein of the pinna and are about a quarter of an inch wide. Each lobe has a median vein which leaves the midvein

[22] Shirley (98), p. 25.

[23] Seward (00), p. 42.

of the pinna at a wide angle (about 60°). These veins are usually opposite or sub-opposite. Branches are given off obliquely and alternately from these veins and they subdivide, forming an irregular network. Finer veinlets end blindly in the meshes of this network.

In fertile specimens the sori, made up of a number of sporangia, are scattered more or less irregularly (Plate 9, fig. 3). No details of the sporangia have been observed.

The sori, as shown on Plate 9, fig. 3, appear to be similar to those in recent species of *Dipteris*, *e.g.*, *D. Lobbiana* var. *Ridleyi*,[24] though the distribution is different in this case.

Locality :—(*Ipswich Series*) : Denmark Hill, Ipswich (F 166).

Figured Specimens : The original of Plate 4, fig. 3, is specimen F 166 in the Queensland Geological Survey Collection ; that of Plate 6, fig. 4(*b*) is specimen S 64 in the " Simmonds " Collection, and that of Plate 9, fig. 3, is specimen 1409 in the University of Queensland Collection.

Dictyophyllum Davidi, n. sp.

(Plate 3, fig. 2.)

This species is distinct from *D. rugosum* and is fairly abundant near Esk. It is a smaller form than *D. rugosum* and differs from it in several respects. More complete examples have been obtained of this species than of *D. rugosum*. Partially complete fronds show the main veins branching dichotomously several times and radiating through the lamina, each ultimate segment being traversed by a prominent median vein. The margin of these segments is not as deeply divided as in *D. rugosum*, nor are the lobes relatively so narrow. From the median vein alternate or sub-opposite veins are given off almost at right angles, and branches from these form an irregular mesh. No fertile examples of this are known.

It is generally a good deal smaller than *D. rugosum*, but there are some larger specimens from the same locality which are imperfect ; it is not possible at present to say whether these larger forms belong to this species or are distinct.

Locality :—(*Walloon Series*) : Portion 28, Par. Biarra (F 165).

Figured Specimen : The original of Plate 3, fig. 2, is specimen F 165 in the Queensland Geological Survey Collection.

[24] Seward and Dale (00), t. 48, fig. 24*a*.

HAUSMANNIA.

Hausmannia Buchii (?) (Andræ).

(Text-fig. 4.)

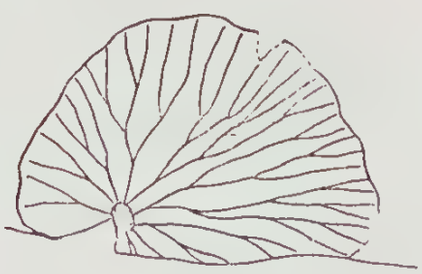
1853. *Protorhipis Buchii*, Andræ, Lias Flora von Steierdorf in Banate, p. 36, t. 8, fig. 1.

1910. *Hausmannia sp.*, Seward, Fossil Plants, II., p. 392, fig. 289.

1911. *Hausmannia Buchii*, Seward, Trans. Roy. Soc., Edinb., 47, p. 658, text-fig. 3.

Two specimens from the Esk district resemble closely in general appearance the orbicular leaves of this species.

In these examples the leaves are orbicular in shape and are traversed by a number of radiating veins which branch dichotomously ; the margin is not well preserved but appears to be entire



Text-figure 4.
Hausmannia (?) *Buchii* (Andrae). (Nat. size.)

or slightly lobed. I have not, however, been able to find definite traces of finer veins at right angles to the main ones, and for this reason some uncertainty must remain as to the determination. It is quite possible that the finer veins were destroyed during fossilisation in a slightly coarse sandstone.

Until further specimens be found little hesitation is felt in placing these examples in the genus *Hausmannia* and comparing them with Seward's figures of *H. Buchii*.

H. Buchii is a Jurassic species, being recorded from the Lias of Steierdorf[25] and from the Jurassic Flora (Kimeridgian) of Sutherland, Scotland.[26]

Somewhat similar species to *H. Buchii* are *H. Kohlmanni* from the Lower Cretaceous of Strohberg and *H. Forchammeri* from the Lias of Bornholm.

Locality :—(*Walloon Series*) : About 6 miles north of Esk.

Text-figure 4 is drawn from specimen 1406 in the University of Queensland Collection.

[25] Andræ (53). [26] Seward (11).

THINNFELDIEÆ. Fam. nov.

The fertile specimens described below show that the genus *Thinnfeldia* belongs to the ferns, but its characters do not agree altogether with any one family of existing ferns.

The sori, which are rather circular and composed of a small number of sporangia (3 to 5), are similar in form to those of the Gleicheniaceæ. The resemblance to this family is heightened by the general form of the fronds, especially the almost constant dichotomy of the rachis and also the form of the pinnules. The apparent absence of an annulus, however, precludes any close relationship with the Gleicheniaceæ and suggests affinity with the Marattiaceæ.

I therefore propose to include the genus *Thinnfeldia* in a new family—the Thinnfeldieæ—combining to some extent characters which indicate affinities with both Gleicheniaceæ and Marattiaceæ.

Professor Seward has suggested to me the possibility that *Thinnfeldia* may be a fairly primitive type of fern (as indicated by its forked fronds and exannulate sporangia) combining features now found in the two families Gleicheniaceæ and Marattiaceæ.

THINNFELDIA.

In 1845 Morris[27] described some fossils from Tasmania as *Pecopteris odontopteroides*. In 1876 Crépin[28] proposed that the species should be transferred to Ettingshausen's genus *Thinnfeldia*, a suggestion which was adopted later by Feistmantel. In 1878 Feistmantel[29] referred to the same species a number of specimens from various localities in Eastern Australia, which differed somewhat from those described by Morris. Later authors have followed Feistmantel in this and for the most part have made little comment on it. As a result there has been a good deal of confusion and uncertainty regarding the specimens referred to *Thinnfeldia odontopteroides*. Other species of *Thinnfeldia* have been described from Eastern Australia from time to time, and in addition a number of varieties of some of the species. The uncertainty in description and determination has not been confined to the species *odontopteroides*, but has applied to an almost equal extent to all the *Thinnfeldias* and to certain very similar specimens described as *Gleichenia*.

The first step towards clearing up the confusion regarding these species was made by Dun[30] in 1909. He discussed both Morris's

[27] Morris (45), p. 249, t. 6.

[28] Crépin (76). This paper is not available in Brisbane. The reference is taken from Antevs (14), p. 5.

[29] Feistmantel (78).

[30] Dun (09), p. 314.

and Feistmantel's types of *Thinnfeldia odontopteroides*, noting the difference between the two, but concluded (p. 314) that "there seems to be no reasonable doubt, however, that Feistmantel's *odontopteroides* is conspecific with that figured by Morris in his figure 3." From a comparison of the figures and descriptions this hardly seems justified.

Dun grouped the various Australian species in a number of divisions thus :—

1. *Thinnfeldia odontopteroides* (Morris' type).
2. *Thinnfeldia odontopteroides* (Feistmantel's type).
3. *Thinnfeldia* i. *lancifolia* type.
   ii. *indica* type.
4. *Thinnfeldia trilobita*, Johnston.
5. *Thinnfeldia* (?) *caudata*, Johnston.
6. *Thinnfeldia McCoyi*, Seward.
7. *Thinnfeldia saligna*, Schenk.

He drew up the synonymy as regards the Australian examples for each group, and his table is most useful on that account.

In 1912 Gothan,[31] in a paper on the genus *Thinnfeldia*, argued that the limits of this genus had been extended considerably by a number of authors, and had come to include many species which should not strictly be referred to *Thinnfeldia*. Among the forms which, according to Gothan, had been wrongly placed in this genus, were all the Australian species named *Thinnfeldia*, and he proposed to remove them and include them under a new genus for which he proposed the name *Dicroïdium*.

The distinction between the two genera he based on the character of the frond, the nature of the venation, and certain characters of the epidermis ; in addition, he believed that the two were distinct as regards geographical distribution, *Thinnfeldia* being confined to the northern Rhaetic region and *Dicroïdium* to the Glossopteris region (Argentine, South Africa, Australia, East Indies).

He described four species of *Dicroïdium*, viz. :—*D. odontopteroides* (Morris), *D. lancifolium* (Morris), *D. Feistmanteli*, n. sp., and *D. dubium* (Feistmantel). The species *D. Feistmanteli* was instituted for the larger bipinnate fronds which Feistmantel had described as *Thinnfeldia odontopteroides*.[32]

It is a strange coincidence that Johnston[33] in 1895 had described or figured a number of specimens of *Thinnfeldia* from Tasmania,

[31] Gothan (12).

[32] *See* above, p. 12. Feistmantel (78) ; *also* (90).

[33] Johnston (95).

amongst which were some he regarded as a new species, to which he gave the name *T. Feistmantelli*. The specimens which Johnston thus named are similar to those which Gothan named *T. Feistmanteli*. Gothan has apparently quite overlooked Johnston's work, and has independently given the same specific name to these forms.

Following Gothan's paper there appeared in 1914 an exhaustive revision of the genera *Thinnfeldia* and *Dicroïdium* by Ernst Antevs.[34] This paper discusses the whole question of *Thinnfeldia* and *Dicroïdium* and of the species referred to each ; although I do not agree with the separation, for reasons given below, the reader is referred to Antevs' paper for many details omitted here.

Although Antevs agrees with Gothan in the establishment of the genus *Dicroïdium*, he does not agree with the grounds on which the separation from *Thinnfeldia* was based. He rightly points out (op. cit., p. 50) that the characters which Gothan used for the separation do not constitute distinctive characters, and shows that there is hardly a character of the one genus which may not exist in the other. He considers, however, that it is desirable to restrict the genus *Thinnfeldia* more closely to its original limits than many authors have done, and that for this reason a number of forms should be removed from *Thinnfeldia*. For a number of these he adopts Gothan's generic name *Dicroïdium*.

Gothan placed all the Australian species of *Thinnfeldia* in the genus *Dicroïdium*, but Antevs retained some of them in the genus *Thinnfeldia*, and so, in his opinion, the distinction based on geographical distribution fails.

Before going further it is desirable to mention more fully the characters in which *Dicroïdium* is stated to be more or less distinct from *Thinnfeldia*.

In *Dicroïdium* the frond is branched or bipinnate, compared with the simple frond in *Thinnfeldia*. Antevs[35] is of opinion that in view of the variable nature of fronds of the same species, and similarity of fronds of quite different species, Gothan has probably laid too much stress on the general form of the frond as a means of separating the genera. The venation of *Thinnfeldia* is usually alethopteroid, while that of *Dicroïdium* is in most cases odontopteroid ; there are, however, exceptions in each case. The forms with typical odontopteroid venation can easily be separated from *Thinnfeldia*, but *Dicroïdium lancifolium*, which has typically alethopteroid venation, seems so closely allied to *D. odontopteroides* that there is at present no

[34] Antevs (14).

[35] Antevs (14), p. 6.

sufficient reason for not placing it in this genus. According to Gothan the cell walls of the epidermis in *Thinnfeldia* are straight and in *Dicroïdium* undulating. Antevs disagrees with this, and my observations on the cuticle of the species *lancifolia* from Petrie's Quarry, Brisbane, also show that in this case at least the cell walls are straight. As mentioned above, Gothan also includes the geographical distribution as a distinctive character.

It has been pointed out by Antevs[36] that no one of these characters is constant for either genus, and as neither Gothan nor Antevs had fertile specimens the question arises whether the sum of these variable characters is of sufficient importance to justify the institution of a new genus.

The descriptions of the two genera are so very similar that they would seem to be of little use in separating the species of one genus from those of the other. In view of this fact, also the absence of fertile specimens, and the author's views on the determination of sterile fronds indicated earlier,[37] it is not considered that the evidence available justified the separation of the genus *Dicroïdium* from *Thinnfeldia*. I have, therefore, retained the name *Thinnfeldia* for the Australian forms under discussion.

Up to the present no fertile specimens of the Australian species of *Thinnfeldia* have been described.

Seward[38] mentions a specimen (v. 5950) in the British Museum, said to come from the Rhætic beds in Queensland. This specimen " shows a row of contiguous polygonal prominences on each side of the midrib which resemble the sori of a fern ; but until sporangia are discovered we cannot determine the precise nature of this apparently fertile frond."[39]

Probably the only other fertile specimen of *Thinnfeldia* known is that figured by Raciborski.[40] In a specimen which he identifies as *T. rhomboidalis*, he figures a fertile fragment showing circular sori made up of several sporangia but no details of the structure of the sporangia.

Specimens of *Thinnfeldia* are so abundant in many localities that the absence of fertile specimens has often been remarked on, and there has been much speculation as to the systematic position of the genus. The finding of several fine examples of fertile fronds at Denmark Hill, Ipswich (24 miles from Brisbane), by Mr. B. Dunstan, Chief Government Geologist, is therefore a discovery of considerable

[36] Antevs (14), pp. 7-9.
[37] Walkom (15), p. 6.
[38] Seward (10), p. 543.
[39] Loc. cit.
[40] Raciborski (94), t. 20, fig. 1, 2.

importance. These specimens are impressions well preserved in a fine-grained shale. They show clearly the form of the sori and sporangia, and also in some cases the cell structure of the sporangium wall (Plate 1, fig. 3; Text-fig. 5).

In addition to the specimens in the Geological Survey collections there is also a fragment in the Simmonds Collection from the same locality, and another from about 7 miles north of Ipswich in the University of Queensland collection.

H. H. Thomas[41] has recently described a leaf-bed at Roseberry Topping, Yorkshire, in which carbonised leaves of *Thinnfeldia rhomboidalis* are very abundant, almost to the exclusion of other forms. In association with these leaves small seed-like bodies, about 5 mm. in diameter, have been found, and Thomas mentions the possibility of these having been the seeds of *Thinnfeldia*. Up to the present, however, there is no real evidence to directly connect the seeds with *Thinnfeldia*.

Briefly the characters of *Thinnfeldia* may be defined as follows :—

Frond pinnate or bipinnate; rachis stout, frequently dichotomous. Pinnules often thick and fleshy; of varying form, from ovate, semi-circular to narrow and elongate, gradually tapering to an acute tip. In the shorter and broader pinnules the venation is odontopteroid, while in the longer and narrower ones it is alethopteroid, with a distinct midrib which may or may not persist to the tip. Epidermis of polygonal cells, usually rectangular above the veins; stomata on both surfaces of the leaf, scattered more or less regularly and slightly sunken.

In fertile fronds the sori are circular and composed of a small number of sporangia; in the specimens available the number varies from 3 to 5. No traces of an annulus have been observed.

Quite a number of the sporangia in these specimens show remains of portion of the cell structure of the wall, and one might reasonably expect to obtain some indication of the annulus if one were present. It would seem, then, a reasonable conclusion that the sporangia in these forms are without an annulus.

There appear to be four fairly distinct forms among the Queensland *Thinnfeldias* to which specific rank may be accorded. These are described here as *T. Feistmanteli*, Johnston, *T. odontopteroides* (Morris), *T. lancifolia* (Morris), and *T. acuta*, n. sp.

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[41] Thomas (15), p. 7.

For the determination of sterile examples of these the following table will be found useful :—

A. Frond bipinnate ; venation odontopteroid.

T. Feistmanteli.

B. Frond dichotomous ;

(*a*) venation odontopteroid.

T. odontopteroides.

(*b*) venation alethopteroid ;

(*a'*) pinnules close, rather obtusely pointed.

T. lancifolia.

(*b'*) pinnules wide apart, very long and acutely pointed.

T. acuta.

Thinnfeldia Feistmanteli, Johnston.

(Plate 1, fig. 3 ; Plate 2, figs. 1, 2 ; Text-fig. 5.)

1885. *Thinnfeldia odontopteroides* var. *obtusifolia*, Johnston, Proc. Roy. Soc., Tas., 1885, p. 371.

1888. *Thinnfeldia obtusifolia* (pars), Johnston, Geology of Tasmania, t. 25, fig. 9 ; t. 26, fig. 17.

1888. *Thinnfeldia* sp. ind., Johnston, *ibid.*, t. 25, fig. 3.

1890. *Thinnfeldia odontopteroides* (pars), Feistmantel, Mem. Geol. Surv., N.S.W., t. 23-25 ; t. 26, fig. 1.

1891. *Thinnfeldia odontopteroides*, Etheridge Jr., Report on Coal-bearing Area in neighbourhood of Leigh's Ck., t. 2, fig. 1, 2 (?).

1895. *Thinnfeldia Feistmantelli*, Johnston, Proc. Roy. Soc., Tas., 1895, figs. 2, 16.

1898. *Thinnfeldia odontopteroides* var. *triangulata*, Shirley, Qland. Geol. Surv., Bull. 7, p. 22, t. 10, fig. 2.

1898. *Thinnfeldia odontopteroides* var. *normalis*, Shirley, *ibid.*, p. 21, t. 11.

1898. *Thinnfeldia odontopteroides* var. *rhachidis*, Shirley, *ibid.*, p. 21.

1910. *Thinnfeldia odontopteroides* (pars), Seward, Fossil Plants, vol. ii., p. 538, fig. 356 (A, B ?, D), 357.

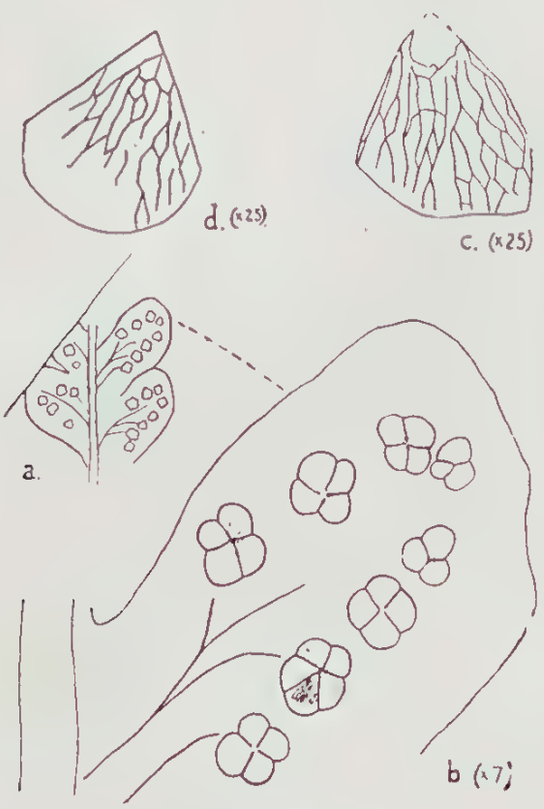
1912. *Dicroïdium Feistmanteli*, Gothan, Abh. Naturh. Ges. Nürnberg, xix., heft 3, p. 78, t. 16, fig. 1.

1913. *Dicroïdium Feistmanteli*, Antevs, K. Svensk. Vetenskaps. Akad., Hand. 50, No. 5, p. 3, t. 1, fig. 1-7.

1914. *Dicroïdium Feistmanteli*, Antevs, id., 51, No. 6, p. 52, t. 1, fig. 5, 6 ; t. 5, fig. 1.

Frond bipinnate, paripinnate with a dichotomous rachis ; apex is formed by a dichotomous branching of the rachis. Pinnæ elongate, gradually tapering, alternate or opposite. Pinnules rhombic, ovate or semicircular, thick, attached by whole of base and connected by very narrow lamina along the rachis. Venation odontopteroid, the veins springing directly from the rachis and dividing once or twice before reaching the margin. Similar pinnules occur on the rachis between the pinnæ, but in this position they may be slightly contracted at the base. Sori circular, composed of 3 to 5 sporangia. Walls of sporangia made up of elongate polygonal cells and apparently there is no annulus.

None of the specimens available have the epidermis preserved ; the characters of the epidermis have, however, been described by Antevs.[42] It is thick on both surfaces of the leaf and is made up of fairly large polygonal cells whose walls are not particularly thick. Stomata are numerous, scattered abundantly over the whole surface, and in approximately the same number on both upper and lower surfaces.



TEXT-FIGURE 5.

Thinnfeldia Feistmanteli, Johnston.

(*a*) Portion of a pinna. (Nat. size.)
(*b*) Single pinnule, showing sori. (x 7.)
(*c*) Single sporangium, showing cells of wall. (x 25.)
(*d*) do. (x 25.)

[42] Antevs (13), p. 4, t. 1, fig. 6, 7 ; (15), p. 53.

The fertile fronds differ a little in general appearance from the sterile. I have, however, no doubt of their belonging to the same species. They were found in a bed in which *Thinnfeldia* is particularly abundant, and in which there is no other species at all resembling the species of this genus. The general habit and venation is quite similar to that of sterile fronds of *T. Feistmanteli*. The pinnules are of the same general form as in sterile fronds, but in most cases they are not completely separated from one another. The sori are arranged parallel to the margins of the pinnules, and there are up to about 8 sori on a single pinnule. The sori are circular and are composed of 3 to 5 sporangia. The cell structure of portion of a sporangium can be observed in a number of cases, and shows a number of somewhat elongated polygonal cells. There is no trace of an annulus.

Localities :—(*Ipswich Series*) : Denmark Hill, Ipswich (F 331) ; Bremer Basin Colliery (F 320) ; Dinmore (F 290) ; Bundamba (F 343.) (*Walloon Series*) : Kilcoy Range, above Cressbrook (F 345); Callide Creek, Port Curtis (F 335) ; Mt. Brisbane Road, 5 miles north of Esk (F 379).

Figured Specimens : The originals of Plate 1, fig. 3, and Plate 2, figs. 1, 2, are specimens F 730 and F 331 in the Queensland Geological Survey Collection. *Text-figure* 5 is drawn from specimen F 310 in the Queensland Geological Survey Collection.

The specific name *Feistmanteli* is adopted since it was the first which applied only to this species. The names *odontopteroides* and *obtusifolia*, which had been used earlier, both applied to at least one other species besides the present one.

The rachis is frequently characterised by a number of transverse markings. These markings show a close resemblance to those shown in *Sphenopteris elegans* (probably = *Heterangium Grievii*) as figured by Scott.[43] This resemblance is so marked as to suggest that the markings in *T. Feistmanteli* may be of similar origin to those of *S. elegans*, in which they are the result of numerous horizontal plates of thick-walled mechanical elements embedded in the tissue of the cortex.[44] It may be stated here that some of the specimens of *Sphenopteris* from the same locality as *T. Feistmanteli* show similar marking of the rachis.

Thinnfeldia odontopteroides (Morris).

(Plate 3, fig. 1.).

1845. *Pecopteris odontopteroides*, Morris in Strzelecki's Physical Description of New South Wales and Van Diemen's Land, p. 249, fig. 2, 3.

[43] Scott (09), p. 415, figs. 159, 160.

[44] Scott (09), p. 407, fig. 154 (c).

1872. *Pecopteris odontopteroides*, Carruthers, Q.J.G.S., xxvii., p. 355, t. 27, fig. 2, 3.

1888. *Thinnfeldia obtusifolia* (pars), Johnston, Geol. of Tasmania, t. 25, fig. 7, 14; t. 26, fig. 21, 7 (?), 15 (?).

1890. *Thinnfeldia odontopteroides*, Feistmantel. Mem. Geol. Surv., N.S.W. Pal. No. 3, t. 26, fig. 2; t. 28, fig. 8; t. 29, fig. 1, 2, 3, 5.

1892. *Thinnfeldia odontopteroides*, Etheridge Jr., Geol. and Pal. Qland, t. 17, fig. 1.

1909. *Thinnfeldia odontopteroides*, Dun, Rec. Geol. Surv., N.S.W., viii., t. 49, fig. 2.

1910. *Thinnfeldia odontopteroides*, Seward, Fossil Plants, ii., p. 538, fig. 358.

1912. *Dicroïdium odontopteroides*, Gothan, Abh. Naturh. Ges., Nürnberg, xix., Heft 3, p. 78, t. 16, fig. 5.

1914. *Dicroïdium odontopteroides*, Antevs, K. Svensk. Vetenskaps. Akad., Hand., Bd. 51, No. 6, p. 55, t. 2, fig. 2, 3; t. 4, fig. 6, 7.

Frond pinnate; rachis strong and dividing dichotomously. The pinnules vary in different parts of the frond; in the upper portion they are oval, rhombic, or somewhat elongate with an obtuse point; they are close together and are attached to the rachis by the whole base and are connected by a narrow lamina along the rachis. The venation is odontopteroid, the veins springing independently from the rachis, sometimes tending to diverge from the central part of the base; they divide dichotomously. Just above the point at which the rachis divides and on the inner side of each branch the pinnules always become short and rounded; below the junction they may be either broad and rounded or somewhat elongate.

This species differs from *T. Feistmanteli* in always having a pinnate frond with the rachis dividing dichotomously instead of a bipinnate frond. The pinnules in general are much more elongate than in *T. Feistmanteli*, being more like those of *T. lancifolia* in general form but there is no midrib.

Localities :—(*Ipswich Series*): ? Loganlea (F 557); Ipswich (F 338); Denmark Hill, Ipswich (F 311); ? Tingalpa (F 321); Petrie's Quarry (F 308); Nixon's Selection, Nerang Creek (F 348); Fairfield (?) (F 297); Tivoli Mine, Ipswich (F 309); South Coast Railway, 15 miles from Brisbane (F 303); Portion 407, Parish of Redland (F 330); Nundah Colliery (F 611); (*Walloon Series*): Mt. Esk (F 322).

Figured Specimen: The original of Plate 3, fig. 1, is specimen 1408 in the University of Queensland Collection.

Thinnfeldia lancifolia (Morris).

(Plate 3, fig. 3; Plate 4, fig. 1; Plate 7, fig. 2; Text-fig. 6.)

1845. *Pecopteris odontopteroides* var., Morris, Strzelecki's Physical Descr. N.S.W. and Van Diemen's Ld., t. 6, fig. 4.

1883. *Thinnfeldia media*, Tenison-Woods, Proc. Linn. Soc., N.S.W., t. 6, fig. 1.

1883. *Thinnfeldia odontopteroides* var. *falcata*, Tenison-Woods, *i bid.*, t. 8, fig. 1.

1885. ? *Thinnfeldia odontopteroides* var. *superba*, Johnston, Proc. Roy. Soc., Tas., p. 372.

1888. *Thinnfeldia media*, Johnston, Geol. Tas., t. 24, fig. 5.

1888. *Pecopteris* (*Thinnfeldia*) *odontopteroides*, Johnston, *ibid.*, t. 25, fig. 1, 2, 4.

1888. *Thinnfeldia superba*, Johnston, ibid., t. 26, fig. 4, 5.

1890. *Thinnfeldia odontopteroides* (pars), Feistmantel, Mem. Geol. Surv., N.S.W., Pal. No. 3, t. 29, fig. 4 (?).

1892. *Thinnfeldia odontopteroides* var., Etheridge Jr., Geol. Pal. Qland., t. 17, fig. 7.

1892. *Thinnfeldia media*, Etheridge Jr., ibid., t. 18, fig. 10.

1895. *Thinnfeldia Buftoni*, Johnston, Proc. Roy. Soc., Tas., 1895, fig. 18.

1898. *Thinnfeldia indica* var. *aquilina*, Shirley, Qld. Geol. Surv., Bull. 7, p. 21, t. 6, fig. 2.

1898. *Thinnfeldia indica* var. *media*, Shirley, ibid., t. 5, fig. 1.

1909. *Thinnfeldia odontopteroides* (pars), Dun, Rec. Geol. Surv., N.S.W., viii., t. 49, fig. 1.

1910. *Thinnfeldia odontopteroides* (pars), Seward, Fossil Plants, ii., p. 538, ? fig. 356C.

1912. *Dicroïdium lancifolium*, Gothan, Abh. Naturh. Ges., Nürnberg, xix., Heft 3, p. 78, t. 16, fig. 2-4.

1913. *Thinnfeldia lancifolia*, Arber, Proc. Roy. Soc., Lond., B 86, p. 346, t. 8, fig. 7.

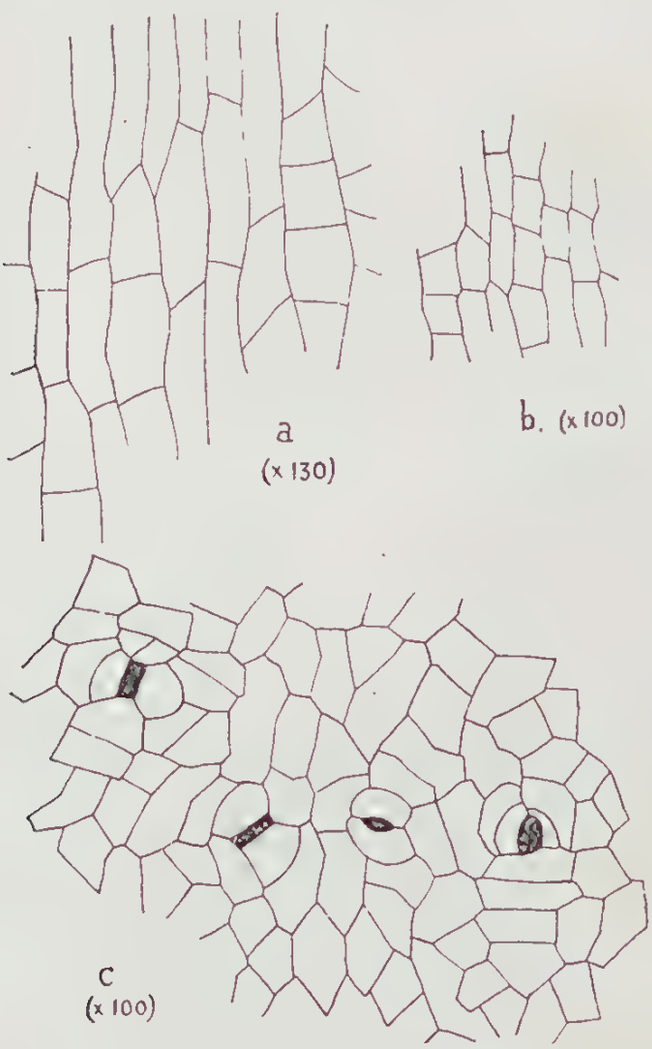
1914. *Dicroïdium lancifolium*, Antevs, K. Svensk. Vetenskaps. Akad., Hand. Bd. 52, No. 6, p. 58, t. 5, fig. 6, 7.

1914. *Thinnfeldia aquilina* (Shirley) (pars), Antevs, ibid., p. 42.

Frond divides dichotomously into two linear pinnæ which are inclined to one another at an acute angle. Pinnules vary in form with their position; the majority are elongate, tapering, with a rather acute tip, and have a distinct midrib which does not usually persist to the tip of the pinnule. The pinnules on the inner sides of the branches become smaller as the point of branching is approached, and gradually change from elongate acute to a rather ovate semi-

circular or more or less rhomboidal shape, without a midrib, the veins arising directly from the rachis. The pinnules on the rachis below the junction may be of either type. The venation is alethopteroid, the secondary veins being given off from the midrib at a rather acute angle. In the basal portion of the pinnules some of the veins come direct from the rachis; the pinnules are decurrent and are connected by a narrow lamina along the rachis.

The structure of the epidermis is shown in text-fig. 6, which is from carbonaceous remains treated with chlorate of potash and nitric acid. They do not add to the descriptions which have already been published.[45]



TEXT-FIGURE 6.
Thinnfeldia lancifolia (Morris).
(*a*) Cuticle over rachis (x 130.)
(*b*) ,, ,, (x 100.)
(*c*) Cuticle of leaf. (x 100.)

The fertile fronds show circular sori composed of a small number of sporangia (4-5); the sori are arranged in two rows parallel to the midrib, one on each side of it. The sori and sporangia appear to be exactly the same as in *T. Feistmanteli*.

[45] Seward (03), t. 9; Antevs (14).

The specimen figured as *T. odontopteroides* var. by Jack and Etheridge[46] has been included by Antevs[47] under the name *T. aquilina*. Examination of the original specimen shows that it is simply a portion of a frond of *T. lancifolia* just above the point where the rachis branches; Antevs[48] suggested this possibility. *Thinnfeldia indica* var. *aquilina*, Shirley,[49] which Antevs[50] placed as *T. aquilina*, should be identified with *T. lancifolia*. The only difference from this species seems to be in the margin of the pinnules, which in the case of *T. lancifolia* is usually entire, but in some cases in this specimen it is somewhat lobed.

Localities :—(*Ipswich Series*): Petrie's Quarry (F 333); Queensport (F 673); Denmark Hill, Ipswich (F 305); (*Walloon Series*): Kilcoy Range, above Cressbrook (F 344); Portion 28, Parish Biarra (F 346); Colinton (F 304).

Figured Specimens: The originals of Plate 3, fig. 3, and Plate 4, fig. 1, are specimens F 729 and F 336 in the Queensland Geological Survey Collection; that of Plate 7, fig. 2, is specimen 1407 in the University of Queensland Collection.

Thinnfeldia acuta, n. sp.

(Plate 3, fig. 4.).

1883. *? Gleichenia (?) lineata*, Tenison-Woods, P.L.S. N.S.W., 8, p. 130, t. 3, fig. 6; t. 8, fig. 2.

1890. *? Gleichenia (?) lineata*, Feistmantel, Mem. Geol. Surv., N.S.W., Pal. 3, p. 112.

1892. *? Gleichenia (?) lineata*, Etheridge Jr., Geol. Pal. Qland., p. 371.

1898. *Thinnfeldia indica* var. *falcata*, Shirley, Qland, Geol. Surv., Bull. 7, p. 21, t. 7, fig. 2.

Frond divides dichotomously into two linear pinnæ; rachis strong. Pinnules some distance apart, long, narrow, tapering gradually to an acute tip, attached by the whole base, decurrent, joined by a narrow lamina along rachis. Venation alethopteroid, midrib prominent and persisting to the tip; secondary veins make an acute angle with the midrib. A few pinnules in the fork between the two branches are modified in shape on account of their position.

The examples described here from Petrie's Quarry are sufficiently distinct to be placed as a separate species. The habit of the frond is much more open than in *T. lancifolia*, the pinnules are much longer and more acutely pointed, and the midrib persists to the tip. The

[46] Etheridge Jr. (92), p. 368, t. 17, fig. 7.
[47] Antevs (14), p. 42.
[48] Antevs (14), p. 43.
[49] Shirley, (98), p. 21, t. 6, fig. 2.
[50] Antevs (14), p. 42.

general appearance is similar to *T. indica*, but the pinnules are not contracted towards the base as appears to be the case in Feistmantel's figures of that species.[51]

Tenison-Woods' figures of *Gleichenia* (*?*) *lineata*[52] are not very distinct, and one cannot be certain of the exact relationships of this species. On account of the general form of the frond and the nature of the pinnules as shown in his figures, it is doubtfully included as a synonym of *T. acuta*, in spite of the fact that there are differences in the descriptions.

The specimen figured by Shirley[53] as *T. indica* var. *falcata* may be taken as the type of this species, but as this specimen is distinct from the figures of *T. falcata* given by Tenison-Woods the name *falcata* cannot be used.

Localities :—(*Ipswich Series*) : Petrie's Quarry (F 352) (*Walloon Series*) : Rosewood, near Ipswich (Tenison-Woods' locality).

Figured Specimen : The original of Plate 3, fig. 4, is specimen F 332 in the Queensland Geological Survey Collection.

? MARATTIACEÆ.

Danæopsis Hughesi, Feistmantel.

(Plate 7, fig. 3.).

1882. *Danæopsis Hughesi*, Feistmantel, Mem. Geol. Surv., India, Pal. Ind. Gondwana Flora, 4, part 1, p. 25, t. 4-10, 18, 19.

1898. *Neuropteris punctata*, Shirley, Qland. Geol. Surv., Bull. 7, p. 20, t. 14, fig. 2.

1903. *Danæopsis Hughesi*, Zeiller, Flore fossile des Gîtes de Charbon du Tonkin, p. 57, t. 9.

1908. *Danæopsis Hughesi*, Seward, Q.J.G.S., 64, p. 95, t. 6.

1910. *Danæopsis Hughesi*, Seward, Fossil Plants, ii., p. 409.

Attention has already been drawn to the close similarity between the fragment figured by Shirley[54] as *Neuropteris punctata* and *Danæopsis Hughesi* Feistmantel by Zeiller[55] and Seward.[56]

No fertile specimens have been described, but Seward[57] notes a close agreement between the sterile leaves from India and South Africa and the fertile fronds of *Marattiopsis marantacea*.

Only the one specimen is available, and there seems little doubt of its identity with *D. Hughesi*.

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[51] Feistmantel (77), t. 39, fig. 1, 1*a*; t. 46, fig. 1, 2, 2*a*.

[52] Tenison-Woods (83), t. 3, fig. 6; t. 8, fig. 2.

[53] Shirley (98), t. 7, fig. 2.

[54] Shirley (98), p. 20, t. 14, fig. 2.

[55] Zeiller (03), p. 58.

[56] Seward (08), p. 97.

[57] Seward (10), p. 409.

D. Hughesi has been recorded from the Middle Gondwana beds of India,[58] the Rhætic of Tonkin,[59] China,[60] and South Africa[61] (Burghersdorp Beds, 1,500 feet below the Molteno beds).

Locality :—(*Ipswich Series*) : Denmark Hill, Ipswich (F 354).

Figured Specimen : The original of Plate 7, fig. 3, is specimen F 354 in the Queensland Geological Survey Collection.

HYDROPTERIDEAE (?)

Sagenopteris rhoifolia (Presl).

(Text-fig. 7.)

1878. *Sagenopteris rhoifolia*, Feistmantel, Palæontographica, Supp. Bd. iii., Lief 3, Heft 4, p. 170, t. 30, fig. 1-4, 7.

1883. *Sagenopteris rhoifolia*, Tenison-Woods, P.L.S. N.S.W., 8, p. 128, t. 9, fig. 4.

1892. *Sagenopteris rhoifolia*, Etheridge Jr., Geol. Pal. Qland., p. 377.

1898. *Sagenopteris rhoifolia*, Shirley, Qland. Geol. Surv., Bull. 7, p. 24, t. 14, fig. 1.

At present there seems to be only a single specimen (F 685) in the Geological Survey collection referable to this species. This is

Text-figure 7.
Sagenopteris rhoifolia (Presl.). (Nat. size.)

from near Toowoomba (*Walloon Series*) ; it has also been recorded from Talgai Diggings, Condamine River (Feistmantel) (*Walloon Series*), and Bundamba (Shirley) (*Ipswich Series*).

Text-figure 7 is drawn from specimen F 685 in the Queensland Geological Survey Collection.

[58] Feistmantel (82), p. 25.
[59] Zeiller (03), t. 9.
[60] Krasser (00), p. 145.
[61] Seward, (08), p. 95.

GENERA OF FERNS AND PLANTÆ INCERTÆ SEDIS.

SPHENOPTERIS.

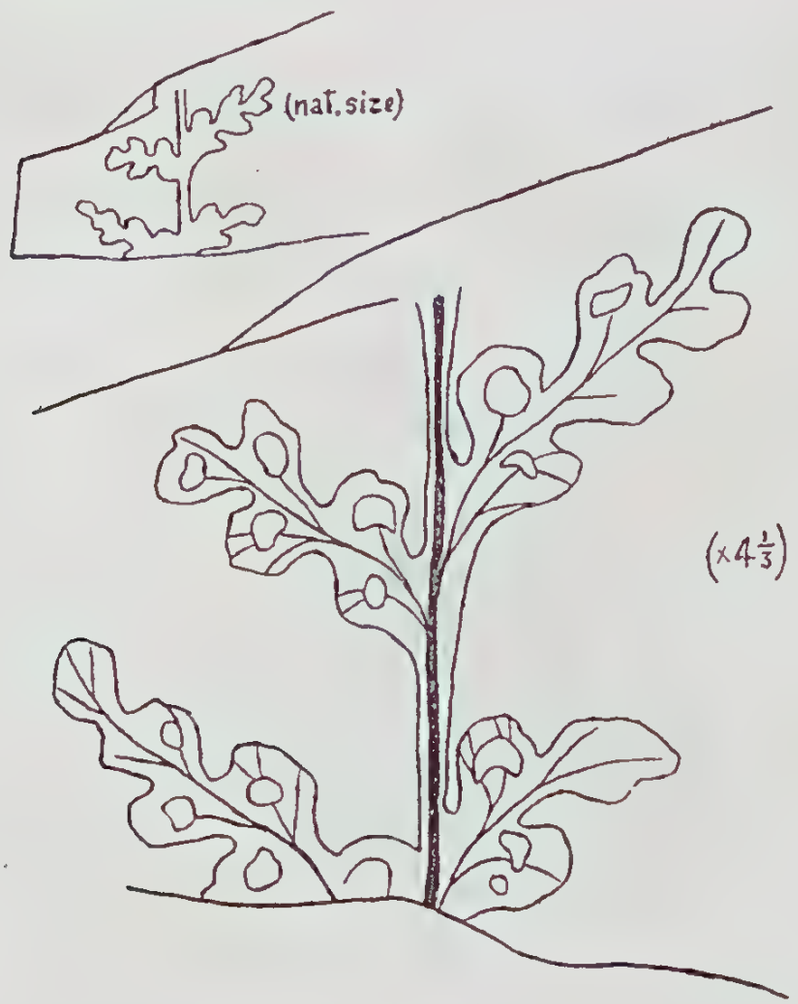
A great variety of sterile fronds has been referred to the form-genus *Sphenopteris*. In a few cases fertile fronds are available and it has been possible to remove these to other genera. The following species have been described under other genera :—*S. elongata*, Carr., under *Stenopteris elongata* ; *S. delicatula*, Shirley, under *Coniopteris delicatula* ; *S. Baileyana* (pars), under *Stenopteris elongata*.

The specimen described by Shirley as *Sphenopteris walchiformis*[62] is a poorly preserved fragment and it is doubtful whether it is worthy of a specific name. No useful purpose seems to be served by retaining it.

SPHENOPTERIS LACUNOSA, Shirley.

(Text-fig. 8.)

1898. *Sphenopteris lacunosa*, Shirley, Qland. Geol. Surv., Bull. 7, p. 19, t. 15, fig. 1.



TEXT-FIGURE 8.

Sphenopteris lacunosa, Shirley. Fertile specimen (×4⅓). (Inset, nat. size.)

[62] Shirley (98), p. 19, t. 16, fig. 1.

This species is quite distinct from any other Queensland example of *Sphenopteris* ; only small portions of the pinnæ have been found. The pinnules are small and rounded, the lamina being divided into a few bluntly rounded lobes as in *S. obtusiloba*.[63] There are a few dichotomously branched veins in each lobe.

In fertile fronds, on the under surface of each lobe there appears to be a single, more or less circular, centrally situated sorus. During preservation the sori have caused the lamina to bulge upwards and now the tops of the elevated portions have been broken away, producing the " lacunæ" mentioned by Shirley.

No details of the structure of the sorus have been preserved. In Shirley's Plate 15, fig. 1, the top right-hand drawing is the counterpart of the one beneath it ; the latter shows the upper surface of the lamina broken away in places and showing the sori underneath.

A general resemblance may be noted between this species and *S. Bunburianus*, Feistmantel,[64] but in the latter species the sporangia are at the ends of the lobes.

Locality :—(*Ipswich Series*) : Denmark Hill, Ipswich (F 255).

Text-figure 8 is drawn from specimen F 255 in the Queensland Geological Survey Collection.

Sphenopteris superba, Shirley.

(Plate 8, fig. 3.)

1898. *Sphenopteris superba*, Shirley, Qland. Geol. Surv., Bull. 7, p. 18, t. 4, 8.

Frond bipinnate ; rachis strong, dichotomous, and marked by a series of transverse pittings. Pinnæ alternate or sub-opposite, elongate, acute, and making an acute angle with the rachis. Pinnules small, variable in shape, those near the apex of a pinna being simple and rather bluntly pointed, those near the base being lobed (with two to five lobes). Venation Sphenopteroid, one vein going to each lobe of the pinnules.

This appears to be a distinct species, and is common in the beds at Denmark Hill, Ipswich. Seward[65] has suggested the possibility that it may be close to *S. ampla*, McCoy, but it seems distinct in the general appearance of the frond and in the character of the pinnules and venation.

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[63] *See* Seward (10), p. 529, fig. 352*c*.

[64] Feistmantel (77), p. 78, t. 32, fig, 5, 6, 7.

[65] Seward (04), p. 166.

Reference has been made to the transverse pitting of the rachis in discussing *Thinnfeldia* (*see above*, p. 19).

Locality :—(*Ipswich Series*) : Denmark Hill, Ipswich (F 274).

Figured Specimen: The original of Plate 8, fig. 3, is specimen F 274 in the Queensland Geological Survey Collection.

Sphenopteris Baileyana, Tenison-Woods.

1883. *Sphenopteris Baileyana*, Tenison-Woods, P.L.S. N.S.W., 8, p. 93, t. 4, fig. 2.

1890. *Sphenopteris Baileyana*, Feistmantel, Mem. Geol. Surv., N.S.W., Pal. 3, p. 90.

1892. *Sphenopteris Baileyana*, Etheridge Jr., Geol. Pal. Qland., p. 366.

It is almost impossible, as already remarked by Etheridge,[66] to make anything of this species from Tenison-Woods' figure.

Tenison-Woods' description of the species is—" Frond bipinnatifid, membranaceous, rachis winged, pinnules alternate, almost simple, broad at the base, becoming regularly narrower at each lobe, so as to form an almost conical leaflet, emerging at an open angle, and curving upwards, the lower shorter, the upper longer and spreading ; lobes linear, narrow, rounded, very slightly segmented, much longer in the upper pinnules, the terminal lobe produced ; costa conspicuous, reaching the apex ; veins very fine, emerging at an acute angle, bifurcating immediately, sending a venule to the end of each lobe."

Both Feistmantel and Etheridge simply repeat the original description. Shirley describes and figures a specimen as *S. Baileyana*, but it is very difficult to separate his specimen from *Stenopteris elongata* (Carr). A series of specimens is figured to show the various types of *S. elongata*, and an examination of these figures shows how close his *S. Baileyana* is to the extreme forms of *S. elongata*. Shirley[67] himself noted that the simpler forms of his *S. Baileyana* showed a very close approximation to *Trichomanites* (= *Stenopteris*) *elongata*.

Locality :—(*Walloon Series*) : Rosewood, near Ipswich (Tenison-Woods' locality).

[66] Etheridge (92), p. 367.
[67] Shirley (98), p. 19.

TÆNIOPTERIS.

A number of writers on Australian Palæobotany have followed Schimper's classification[68] for those fossil leaves which would be included under Brongniart's genus *Tæniopteris*.[69] These are simple linear or broadly linear leaves with a prominent midrib and secondary veins which come off from the midrib either at right angles or obliquely, and which are simple or dichotomously branched.

This classification involves the use of the following generic names :—*Tæniopteris*, Brong. ; *Macrotæniopteris*, Schimper ; *Palæovittaria*, Feist. ; *Oleandridium*, Schimper ; *Angiopteridium*, Schimper ; and *Marattiopsis*, Schimper. Four of these have been applied to plant fossils from Australia, viz., *Tæniopteris*, *Macrotæniopteris*, *Oleandridium*, and *Angiopteridium*.

The use of names such as *Palæovittaria*, *Oleandridium*, *Angiopteridium*, and *Marattiopsis*, closely related as they are to the names of recent genera, implies a definite relationship with such recent genera. Such relationship, however, is quite unknown in the case of any of the Australian fossils.

Further, the distinctions between species of these genera have been based on the variations in shape of the leaves, in the prominence of the midrib, and in the nature and distribution of the secondary veins. The distinctions between the genera themselves have consisted mainly in the size and shape of the leaves. Such characters do not seem to be of sufficient importance to serve as the basis of a scheme for the classification of the *Tæniopterideæ* such as that outlined by Schimper.

Until examples are obtained giving evidence of the nature of the reproductive organs it is impossible to determine the affinities of this group.

It is, therefore, proposed here to discontinue the use of such generic names as *Oleandridium* and *Angiopteridium* until some proof is available of the relation between the fossils and the recent genera with which some connection is implied. The genus *Macrotæniopteris* only differs from *Tæniopteris* in size, and the retention of this name serves no useful purpose.

The whole of the species in this group, then, are here classed under the genus *Tæniopteris*. This arrangement is not new ; the same opinion has already been expressed by a number of the most prominent palæobotanists of recent times, viz., Nathorst,[70] White,[71] Seward,[72] Zeiller,[73] and Arber.[74].

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[68] Schimper (69-74), i., p. 600.
[69] Brongniart (28), p. 61.
[70] Nathorst (78-86).
[71] White (93), p. 119.
[72] Seward (94), p. 124.
[73] Zeiller (03), p. 59.
[74] Arber (05), p. 120.

The various species of *Tæniopteris* are common in rocks of the Rhætic and Jurassic periods, and in themselves are not of any considerable value as index fossils.

Tæniopteris spatulata, McClelland.

(= *T. Daintreei*, McCoy.)

(Plate 5, fig. 2(*b*).)

Only a few of the more important references are given in the synonymy here in addition to the Queensland references. The full list will be found in Dun (98), p. 390, and Seward (04), p. 168.

1850. *Tæniopteris spatulata*, McClelland, Rep. Geol. Surv. India, p. 53, t. 16, fig. 1.
1860. *Tæniopteris Daintreei*, McCoy, Trans. Roy. Soc. Vic., 5, p. 97.
1890. *Tæniopteris Daintreei*, Feistmantel, Mem. Geol. Surv. N.S.W., Pal. 3, p. 114, t. 27, fig. 4, 5 ; t. 28, fig. 6, 6*a*.
1892. *Tæniopteris* (*? Angiopteridium*) *Daintreei*, Etheridge Jr., Geol. Pal. Qland, p. 371.
1898. *Tæniopteris* (*Angiopteridium*) *spatulata*, Shirley, Qland. Geol. Surv., Bull. 7, p. 23.
1898. *Angiopteridium Daintreei*, Dunstan, Qland. Geol. Surv., Pub. 131, t. 5.
1898. *Angiopteridium spathulatum*, Dun, A.A.A.S., 7, p. 390.
1902. *Tæniopteris spatulata*, Shirley, Qland. Geol. Surv., Bull. 18, p. 12.
1902. *Oleandridium jaculi*, *ibid.*, p. 12, t. 8.
1904. *Tæniopteris Daintreei*, Seward, Rec. Geol. Surv. Vic., 1, part 3, p. 168.

"Frond simple, linear, long and narrow, reaching a length of more than 7 c.m and varying in breadth from 1·5 mm. to slightly more than 1 cm. The apex is either gradually tapered to an acuminate tip or bluntly rounded ; towards the petiole the lamina becomes gradually narrower. Midrib stout and prominent, giving off numerous secondary veins, usually at right angles ; these veins are frequently forked close to the midrib, or the branching may occur at varying distances between the midrib and the edge of the leaf. The veins are delicate and numerous, approximately fifteen veins per 5 mm. of lamina. Towards the apex of the fronds the secondary veins become oblique, branching at a wide angle from the midrib." (Seward).[75] *Tæniopteris Daintreei*, McCoy, is here regarded as synonymous with *T. spatulata*, McClelland. Much has been written at various times as to the identity or otherwise of these two species,

[75] Seward (04), p. 168.

and there will probably always be advocates for each view. Those who believe in adopting broad specific definitions for such sterile fronds as these will be inclined to unite the two ; those who believe that narrower specific definitions can be maintained will separate them.

The specimen originally described by McCoy[76] as *T. Daintreei* certainly differs from the original of *T. spatulata*, but the examination of a large number of specimens reveals many examples intermediate between the two and makes it difficult to offer reasonable grounds for separating them.

It has been pointed out by Etheridge[77] that there is a noticeable difference between some of the Queensland examples and the Victorian *T. Daintreei*, and that McCoy was of opinion that they were specifically distinct. Etheridge expresses the difference between the two species thus—" the veins in the former (*T. Daintreei*) seem to be still straighter and are thicker than in *T. spatulata*." He adds (p. 373)—" It will not, however, surprise me if these species have to be united ; if not, most of the Queensland fronds will have to be referred to *Angiopteridium spathulatum*, McClelland."

Specimens which are undoubtedly identical with the original *T. Daintreei*, McCoy, have now been found in Queensland, *e.g.*, from Beaudesert and from Clifford, north of Yuelba, and since there are intermediate forms between these and those mentioned by Etheridge it is better to regard the whole as one species.

The form of the frond—long, narrow, linear—and the nature of the venation distinguish *T. spatulata* from other species.

It may be noted that in some specimens from Stewart's Creek there is a certain amount of variation in the course of the secondary veins ; some of them, instead of being at right angles to the midrib, are slightly oblique (80° to 90°) as noticed by Etheridge[78] for Clarence River or Queensland specimens, and in addition they occasionally have a slight curve upwards towards the margin. This might easily be a result of the conditions of preservation.

By several writers this species has been placed in the genus *Angiopteridium*, without, it seems, sufficient evidence. The only decisive evidence would be the discovery of fertile specimens. In referring specimens to this genus Feistmantel[79] says—" from the size and form of the leaf, and from the distribution of the veins I should think that this species ought to be placed in the genus

[76] McCoy (60) p. 97.

[77] Etheridge (92), p. 372.

[78] Etheridge (92), p. 372, t. 18, fig. 12, 13.

[79] Feistmantel (90), p. 114.

Angiopteridium." Dun[80] classes *T. Daintreei* as the variable representative of the Indian *Angiopteridium spathulatum*, McClelland, but gives no reason for adopting the name *Angiopteridium*. Seward[81] says—" as yet we have no data which enables us to refer either the Australian or Indian fronds (of *Tæniopteris*) to a particular family of ferns."

The specimen described by Shirley[82] as *Oleandridium jaculi* seems identical with a specimen from Victoria figured by Seward,[83] and is here regarded as synonymous with *T. spatulata*.

Localities :—(*Walloon Series*) : Stewart's Creek, near Stanwell (F 446, 426) ; Beaudesert (F 445) ; Zerner's farm, Templin, near Engelsberg (F 642) ; Rosewood, near Ipswich (F 643) ; Stanfield's Selection, Beaudesert (F 647) ; Portion 146, Par. Colamba (near Chinchilla) (F 419).

Figured Specimen : The original of Plate 5, fig. 2(*b*), is specimen F 445 in the Queensland Geological Survey Collection.

Tæniopteris spatulata var. major, Seward.

(Plate 8, fig. 2.)

1904. *Tæniopteris Daintreei* var. *major*, Seward, Rec. Geol. Surv., Vic., vol. i., part 3, p. 171, fig. 23, 24.

A few larger specimens in which the veins are somewhat closer together may be classed with the specimens to which Seward gave the name *T. Daintreei* var. *major*. These specimens come from Stewart's Ck., Stanwell (F 651) and Beaudesert (F 410), both in the *Walloon Series*.

Figured Specimen : The original of Plate 8, fig. 2, is specimen F 651 in the Queensland Geological Survey Collection.

Tæniopteris Tenison-Woodsi, Etheridge Jr.

(Text-fig. 9.)

1883. *Angiopteridium ensis*, Tenison-Woods ; (*non* Oldham and Morris) ; P.L.S. N.S.W., 8, p. 119.

1890. *Angiopteridium ensis*, Feistmantel, Mem. Geol. Surv., N.S.W., Pal. 3, p. 116.

1892. *Angiopteridium Tenison-Woodsi*, Etheridge Jr., Geol. Pal. Qland., p. 375.

1898. *Tæniopteris* (*Angiopteridium*) *Tenison-Woodsi*, Dun, A.A.A.S., 7, p. 375.

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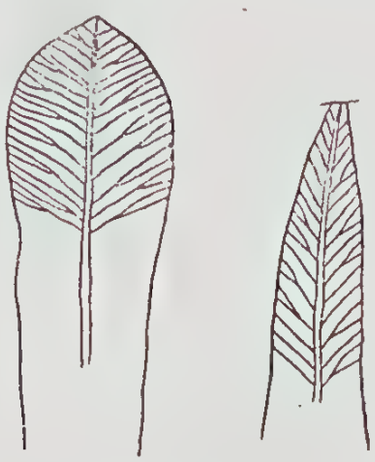
[80] Dun (98), p. 393.
[81] Seward (04), p. 169.
[82] Shirley (02), p. 12, t. 8.
[83] Seward (04), t. 13, fig. 21.

1898. *Tæniopteris Tenison-Woodsi*, Shirley, Qland. Geol. Surv., Bull. 7, p. 23, t. 9, fig. 2.

1903. *Tæniopteris Carruthersi* (pars), Seward, Annals S. Af. Mus., 4, t. 8, fig. 5.

Frond simple, linear, long and narrow, reaching a length of 21 cm. and a width up to 8 cm. The apex may be obtuse or gradually tapered to an acute tip. The midrib is stout and thick, being from ·5 to 1 mm. in width ; it persists to the tip, is striate, and gives off numerous secondary veins which make an angle of from 30° to 60° with the midrib. Where the apex is obtuse a small number of veins close to the tip of the frond are almost at right angles to the midrib. The secondary veins are simple or forked and the forking may take place near the midrib or close to the margin ; they are straight or occasionally curve slightly away from the midrib ; they are approximately 1 mm. apart at the margin. The lamina tapers gradually towards the petiole.

The longest specimen examined is 16 cm. long and its greatest width is at a point situated about 1 cm. from the apex, which is obtuse ; at this point the width is 1 cm., and at the lower end the width is 5 mm. ; the specimen is not quite complete.



TEXT-FIGURE 9.

Tæniopteris Tenison-Woodsi, Etheridge Jr. Apical portions of leaves. (Nat. size.)

This species was originally described by Tenison-Woods[84] as *Angiopteridium ensis*, O and M., but Etheridge[85] has pointed out that the specimen described by Tenison-Woods does not correspond with the latter's description or with the description and figure of Oldham and Morris.[86] Neither Tenison-Woods nor Etheridge figured the species, the earliest figure being that of Shirley[87] in 1898.

[84] Tenison-Woods (83), p. 119.

[85] Etheridge (92), p. 375.

[86] Oldham and Morris (63), p. 35, t. 6, fig. 8, 9, 10.

[87] Shirley, (98), t. 9, fig. 2.

Tæniopteris Tenison-Woodsi is quite distinct from any other species of *Tæniopteris*. The form of the frond is very similar to that of *T. spatulata*, McClelland, but it is readily separated from that species by the angle which the secondary veins make with the midrib. A number of species of *Tæniopteris* have the secondary veins making an angle of less than 90° with the midrib, but the present species differs distinctly from these in the form of the frond.

This species has only been described from Australia, but part of a frond from South Africa figured by Seward[88] as *T. Carruthersi* resembles it fairly closely. It is there suggested[89] that the specimen may be from the lower part of a frond of *T. Carruthersi*, but from the almost parallel sides and the nature of the secondary veins I have ventured to suggest that it may quite well belong to *T. Tenison-Woodsi*. The South African specimen comes from the Stormberg Beds at Kenigha River, of Rhætic Age.

Localities :—(*Ipswich Series*) : Denmark Hill, Ipswich (F 396) ; Campbell's Quarry, Albion ; Nundah Colliery (F 604) ; Railway Cutting, Ycronga (F 369). (*Walloon Series*) : Stewart's Creek (F 401) ; Portion 33, Parish Esk (F 399).

Text-figure 9 is drawn from specimens S 37 and S 66, in the "Simmonds" Collection.

Tæniopteris Carruthersi, Tenison-Woods.

(Text-fig. 10.)

1872. *Tæniopteris Daintreei*, Carruthers, Q.J.G.S., 28, p. 355, t. 27, fig. 6.

1878. *Tæniopteris Daintreei*, Feistmantel, Palæontographica, Supp. Bd. iii., Lief 3, Heft 3, t. 14, fig. 4 (*non* 2 and 3).

1883. *Tæniopteris Carruthersi*, Tenison-Woods, P.L.S. N.S.W., 8, p. 117.

1885. *Tæniopteris Carruthersi*, Johnston, Proc. Roy. Soc. Tas., p. 375.

1890. *Tæniopteris Carruthersi*, Feistmantel, Mem. Geol. Surv., N.S.W., Pal. 3, p. 115, t. 28, fig. 7.

1892. *Tæniopteris Carruthersi*, Etheridge Jr., Geol. Pal. Qland., p. 374.

1898. *Tæniopteris Carruthersi*, Dun. A.A.A.S., p. 393.

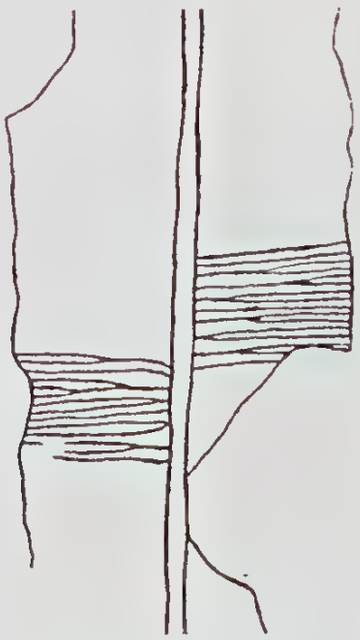
This is not a very satisfactory species to deal with. It has only been very briefly described and the figures published only represent fragments. Indeed, complete specimens do not seem to have been

[88] Seward (03), t. 8, fig. 5.

[89] Op cit., p. 60.

found. Carruthers' original description[90] is "Frond simple (?), broadly linear, costa somewhat thick, veins leaving at an acute angle, then passing out at right angles to the margin, once or twice dichotomously divided."

It is a larger species than *T. spatulata*. In Carruthers' original figure the leaf is 3 cm. in width with a midrib 1 to 2 mm. broad, and tapers towards the apex. There are approximately 15 veins per



TEXT-FIGURE 10.

Tæniopteris Carruthersi, Tenison-Woods. (Nat. size.)

cm. at the edge of the lamina. Feistmantel's figure[91] is a copy of Carruthers'. Seward[92] figures three specimens from South Africa from the Stormberg Beds of Rhætic age. One of these I have referred to *T. Tenison-Woodsi* (*see* above, p. 34).

The general appearance of this species, in conjunction with the fact that only fragments have been found, suggests that it may have been a more fragile form than the other species of *Tæniopteris*.

Localities :—(*Ipswich Series*) : Tingalpa (F 364) ; Nundah Colliery (F 614). (*Walloon Series*) : ? Mt. Esk (F 371).

Text-figure 10 is drawn from specimen F 364 in the Queensland Geological Survey Collection.

TÆNIOPTERIS LENTRICULIFORME (Etheridge Jr.).

(Text-fig. 11.)

1894. *Oleandridium lentriculiforme*, Etheridge Jr., Rec. Geol. Surv. N.S.W., 4, p. 49, t. 8, fig. 1, 2, 3.

[90] Carruthers (72), p. 355.

[91] Feistmantel (90), t. 28, fig. 7.

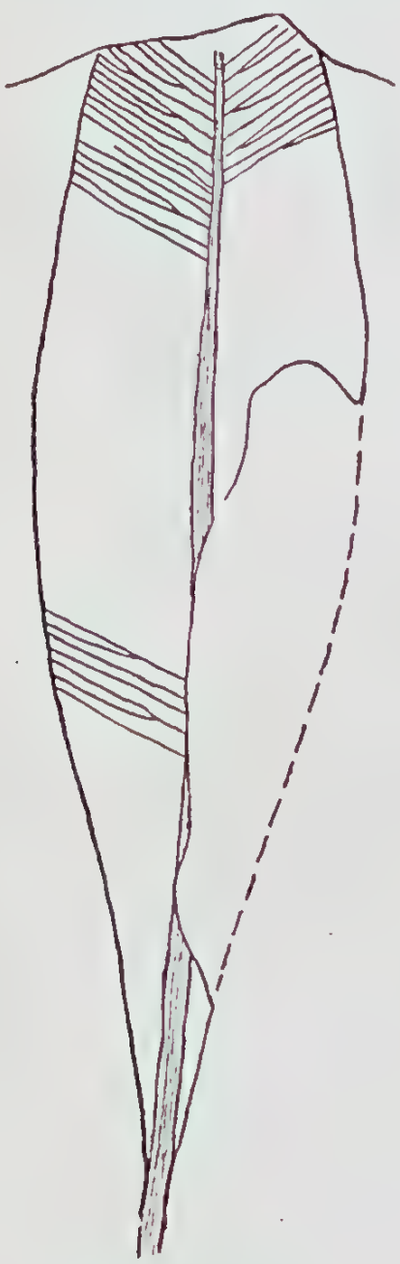
[92] Seward (03), t. 8, fig. 4, 5, 6.

1898. *Oleandridium lenticulariforme*, Shirley, Qland. Geol. Surv., Bull. 7, p. 28, t. 7, fig. 3.

1898. *Tæniopteris Etheridgei*, ibid., p. 23, t. 9, fig. 1.

1898. *Oleandridium lentriculiforme*, Dun, A.A.A.S., 7, p. 396.

"Leaves simple, elongately lanceolate or boat-shaped, broad in the centre, attenuating both towards the apex and base, petiolate and apparently more or less coriaceous; apex obtuse to a variable degree but never acute; petiole long and strong; margins entire



Text-figure 11.

Tæniopteris lentriculiforme, Etheridge Jr. (Nat. size.)

and not waved, gently curved from base to apex; midrib broad and strong near the base, rapidly decreasing upwards to a fine vein; secondary veins rather variable in number in a given space, but generally about three in the space of 1 mm., issuing from the midrib

MINES DEPT. VICTORIA

at an oblique angle but without any change in the direction of their course ; seldom dichotomous but when so once only and then near the midrib." (*Etheridge*).

This species was described by Etheridge from the Hawkesbury Series of Sydney. There are numerous specimens from Queensland which have hitherto gone under this name, but the majority of them I propose to remove into a new species—*Tæniopteris Dunstani* (*see* below). A number of specimens, however, belong to *T. lentriculiforme*.

Shirley[93] described a specimen from Ipswich as *T. Etheridgei* but later,[94] after examination of further specimens, he concluded that the specimens should be referred to *Oleandridium lentriculiforme*, and hence the name *T. Etheridgei* should lapse.

Localities :—(*Ipswich Series*) : Denmark Hill, Ipswich (F 519) ; ? Kelly's Brick Pit, Murarrie (F 558).

Text-figure 11 is drawn from specimen F 519 in the Queensland Geological Survey Collection.

Tæniopteris Dunstani, n. sp.

(Plate 9, fig. 1.).

Leaves simple, long, somewhat strap-shaped, narrowing towards apex and base. Length more than 12 cm., breadth up to 2·8 cm. ; petiole strong ; apex more or less acute ; midrib distinct and persisting to the apex, striated longitudinally and pitted, and attaining a breadth up to 2 mm. The secondary veins make an angle of about 70° with the midrib ; they are simple or forked and occasionally two adjacent ones join ; this joining of adjacent veins is a constant feature ; at their outer extremities the secondary veins join to form a distinct marginal vein. The number of secondary veins varies from 16 to 24 per cm.

Type : F 372 in the Geological Survey Collection, from Denmark Hill, Ipswich.

This species includes most of the Queensland specimens which have hitherto been identified as *Oleandridium lentriculiforme*. At first sight it resembles *T.* (*Oleandridium*) *lentriculiforme*, but closer examination reveals certain constant differences which seem to warrant separation as a distinct species. The leaf is more elongated than in *T. lentriculiforme*, being rather strap-shaped than lanceolate or boat-shaped, *e.g.* one incomplete specimen has a length of 12 cm. and is 1·2 cm. wide at its lower end, 1·6 cm. wide at about the

[93] Shirley (98), p. 23, t. 9, fig. 1.

[94] Shirley (02), p. 12.

middle, and ·8 cm. wide at the upper end. Other specimens show about the same relative proportions. It also differs from *T. lentriculiforme* in the fact that in each specimen there are a number of cases in which adjacent secondary veins join. I have examined counterparts of the original specimens of *T. lentriculiforme* in Mr. Dunstan's collection and there is no sign of adjacent secondary veins joining. This feature has been noted by Feistmantel[95] in the case of *T. crassinervis* from the Rajmahal Group in India.

The present species also shows a general resemblance to *T. vittata* from the Lower Oolite of England but differs from it in the venation. It is unlike any other Australian species.

The general shape of the leaf and the pitted and striated nature of the midrib are essentially characters which place the present species in *Tæniopteris*.

Localities :—(*Ipswich Series*) : Denmark Hill, Ipswich (F 372) ; Windsor Town Quarry, Albion (F 389) ; Railway Cutting, Oxley (?), (F 382).

Figured Specimen : The original of Plate 9, fig. 1, is specimen F 372 in the Queensland Geological Survey Collection.

Tæniopteris wianamattæ, (Feistmantel).

1878. *Macrotæniopteris wianamattæ*, Feistmantel, Palæontographica, Supp. Bd. iii., Lief 3, Heft 3, p. 107, t. 13, fig. 2.
1883. *Macrotæniopteris wianamattæ*, Tenison-Woods, P.L.S. N.S.W., 8, p. 118, t. 10a.
1890. *Macrotæniopteris wianamattæ*, Feistmantel, Mem. Geol. Surv. N.S.W., p. 116.
1892. *Macrotæniopteris wianamattæ*, Etheridge Jr., Geol. Pal. Qland., p. 376.
1892. *Macrotæniopteris* sp., ibid., p. 377.
1898. *Macrotæniopteris wianamattæ*, Dun, A.A.A.S., 7, p. 397.
1898. *Macrotæniopteris Woodsi*, ibid., p. 399.

"Frond elongately obovate, simple, base attenuate, apex (?) ; rachis thick, grooved or striated ; veins emerging at an angle of 20°-25°, close, near the rachis ·6 to ·8 mm. apart, slender, dichotomous towards the margin." (*Feistmantel.*)

This is one of the large species of *Tæniopteris*. It has been recorded from Ipswich by Tenison-Woods,[96] but seems to be of rare occurrence in Queensland.

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[95] Feistmantel (77), p. 51.
[96] Tenison-Woods (83), p. 118.

It is distinct from all the Australian species except *T. crassinervis* in its size. From this species it differs in the veins being usually closer together and in the shape of the leaf, which in *T. crassinervis* is long and wide with rather parallel sides. In *T. crassinervis* also the midrib is usually relatively broader than in *T. wianamattæ*.

Feistmantel compared this species with *T. superba*, Saporta.[97]

It is probable that the specimen recorded by Etheridge as *Macrotæniopteris* sp.[98] from Tivoli Coal Mine is not separable from *T. wianamattæ*. Dun[99] records this specimen as *M. Woodsi*, the name suggested by Etheridge if it should be a new species, but regards it only as a variety of *M. wianamattæ*.

Localities :—(*Ipswich Series*): Ipswich (Tenison-Woods' locality) ; Tivoli Coal Mine (Etheridge).

Tæniopteris crassinervis, (Feistmantel).

(Plate 1, fig. 2.).

1877. *Macrotæniopteris crassinervis*, Feistmantel, Mem. Geol. Surv. India, Pal. Ind., Gondwana Flora, 1 (2), p. 102, t. 38, fig. 1-3.

1892. *Macrotæniopteris crassinervis*, Etheridge Jr., Geol. Pal. Qland., p. 376, t. 16, fig. 5.

1898. *Macrotæniopteris crassinervis*, Dun, A.A.A.S., 7, p. 398.

"Frond very large, single, strong, thick and coriaceous, broad, elongately obovate ; margins plain, apex obtusely rounded, not re-entrant ; midrib distinct but not wide for the size of the frond, vertically ridged ; veins, except near the apex, diverging at a right angle or nearly so, very strong ; distant from one to one and a half mm. apart, very regular and direct in their course, simple or forked ; dichotomisation at irregular intervals but always dividing close to the midrib." (*Etheridge*).

This species is characterised by its size and its coarse venation. The specimens which I have examined are rather broad strap-shaped and in this respect are distinct from the species *T. wianamattæ*. No fresh specimens have been obtained since Etheridge described the Queensland specimens so there is nothing to add to his remarks.

In this species Feistmantel[100] has recorded the occasional joining of two adjacent secondary veins, a feature which is constant in *T. Dunstani*.

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[97] Saporta (73), p. 439.

[98] Etheridge (92), p. 377.

[99] Dun (98), p. 399.

[100] Feistmantel (77), p. 51, t. 38, fig. 2.

T. crassinervis occurs in the flora of the Rajmahal Group in India, this flora being of Liassic character with some relations to Rhætic forms (Feistmantel).

Localities :—(*Walloon Series*) : Wycarbah, near Rockhampton (F 361) ; Redbank, near Mt. Esk (F 367) ; Callide Ck., Port Curtis (F 365).

Figured Specimen : The original of Plate 1, fig. 2, is specimen F 367 in the Queensland Geological Survey Collection.

STENOPTERIS.

Stenopteris elongata, (Carruthers).

(Plate 1, fig. 1 ; Plate 6, figs. 1–4*a*.).

1872. *Sphenopteris elongata*, Carruthers, Q.J.G.S., 28, p. 355, t. 27, fig. 1.

1883. *Trichomanides spinifolium*, Tenison-Woods, P.L.S. N.S.W., 8, p. 95, t. 3, fig. 7.

1883. *Sphenopteris elongata*, ibid., p. 92.

1890. *Trichomanides spinifolium*, Feistmantel, Mem. Geol. Surv. N.S.W., Pal. 3, p. 95.

1892. *Trichomanites spinifolia*, Etheridge Jr., Geol. Pal. Qland., p. 367, t. 18, fig. 8.

1892. *Trichomanites elongata*, ibid., p. 367.

1898. *? Sphenopteris Baileyana*, Shirley, Qland. Geol. Surv., Bull. 7, p. 19, t. 7, fig. 1.

1898. *Trichomanites elongata* var. *spinifolia*, ibid., p. 19, t. 5, fig. 2.

1898. *Trichomanites elongata*, ibid., t. 10, fig. 3.

1903. *Stenopteris elongata*, Seward, Ann. S. Af. Mus., 4, part 1, p. 70, t. 7, fig. 2, 3 ; t. 11, fig. 3.

The available collections contain a large number of specimens referable to this species, and show the impossibility of delimiting more than one specific type. The specimens figured give some idea of the range of variation. An almost complete series of forms intermediate between those figured can be obtained.

The species was first described by Carruthers[101] as *Sphenopteris elongata* from the Tivoli Coal Mine, Ipswich. *Trichomanides spinifolium* was described by Tenison-Woods[102] in 1883, but Shirley[103] later placed this as a variety of Carruthers' species *elongata* which had been transferred to the genus *Trichomanites* by Etheridge.[104]

[101] Carruthers (72), p. 355.
[102] Tenison-Woods (83), p. 95.
[103] Shirley (98), p. 19.
[104] Etheridge (92), p. 367.

Seward,[105] in describing some South African specimens, fully discussed the question of the generic determination of the species and provisionally placed it in Saporta's genus *Stenopteris*.[106] Nothing whatever is known of the affinities of this species, hence any generic determination must only be provisional. The nature of the fronds led Seward[107] to doubt the identification of these fossils as ferns.

Saporta[108] had suggested the possibility that *Stenopteris* may be more closely allied to the cycads than the ferns.

The South African specimens do not exhibit clear indications of a median vein, but the presence of a well-defined median vein is a constant and characteristic feature of the Queensland specimens.

The figures of *Trichomanides spinifolium* and *T. elongata* by Tenison-Woods,[109] Etheridge,[110] and Shirley,[111] however, do not show clearly the characteristic midvein. I have examined the originals of both Etheridge's and Shirley's figures; in the specimen figured by Etheridge there is a very distinct trace of the midrib, though it is not so prominent as in the majority of specimens; in those figured by Shirley the midrib is a prominent feature.

Dun[112] has described the species *Stenopteris rigida* from N.S.W. differing from the Queensland specimens "by their more rigid appearance, regularly pinnate form, and symmetrical dichotomy." His figure does not show a midrib, and as he does not mention it in his description it may be assumed that there is no median vein, and this is an additional difference between the N.S.W. and Queensland forms, and a point of resemblance between the N.S.W. and South African forms.

The frond is dichotomously branched, each branch being pinnate. The pinnæ may be simple, linear, or they may be pinnate to a varying extent; the segments are linear, usually somewhat bluntly pointed, and each possesses a single median vein. In some of the extreme forms the segments may be bi- or tri-lobed, each lobe having a single vein. The rachis frequently bears transverse markings similar to those noted in *Thinnfeldia* and *Sphenopteris*.

Localities :—(*Ipswich Series*) : Denmark Hill (F 266); Petrie's Quarry (F 745); Railway, N. of Kingston (F 275); Tivoli (F 282); ? Bundamba (New Chum) (F 267); ? Bremer Basin Colliery (F 277); (*Walloon Series*) : Mt. Esk (F 281).

[105] Seward (03), p. 70.
[106] Saporta (73), p. 290.
[107] Op cit., p. 71.
[108] Saporta (73), p. 290.
[109] Tenison-Woods (83), t. 3, fig. 7.
[110] Etheridge (92), t. 18, fig. 8.
[111] Shirley (98), t. 5, fig 2; t. 10, fig. 3.
[112] Dun (09), p. 313, t. 50, fig. 1, 2.

Figured Specimens : The originals of Plate 1, fig. 1, and Plate 6 are specimens S 42, S 62, S 65, S 41, and S 64 in the "Simmonds" Collection in the University of Queensland.

PHYLLOPTERIS, Saporta.

Phyllopteris Feistmanteli, Etheridge Jr.

(Text-fig. 12.)

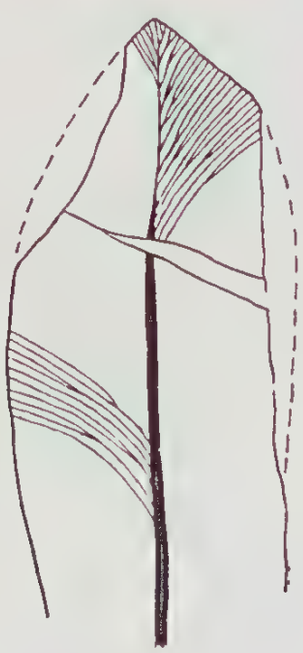
1892. *Phyllopteris Feistmanteli*, Etheridge Jr., Geol. Pal. Qland., p. 375.

1898. *Phyllopteris Feistmanteli*, Dun, A.A.A.S., 7, p. 399.

1898. *Phyllopteris Feistmanteli*, Dunstan, Qland. Geol. Surv., Pub. 131, t. 5.

"Frond or leaflet oval, or broadly lanceolate, slightly petiolate ; midrib very distinct, evanescing towards the apex of the leaflet, but tapering very slowly ; veins springing outwards from the midrib at a very acute angle, then gracefully curving outwards to the margin, fine, once or twice furcate." (*Etheridge.*)

This species, which is of limited occurrence in this flora, was referred by Etheridge to Saporta's genus *Phyllopteris*. The general



Text-figure 12.

Phyllopteris Feistmanteli, Etheridge Jr. (Nat. size.)

shape of the leaves is similar to the leaves of *Sagenopteris* found in rocks of the same age in Queensland, but in *Phyllopteris* the veins bifurcate but do not anastomose. It may be noted that Dun,[113] in quoting Saporta's description of the secondary veins, describes them

[113] Dun (98), p. 388.

as " anastomosing " instead of " not anastomosing." In some of the specimens from Stewart's Creek, Stanwell, the veins are finely undulating.

Localities :—(*Walloon Series*) : Stewart's Ck., near Rockhampton (F 356) ; Stewart's Creek, Stanwell (F 743).

Text-figure 12 is drawn from specimen F 741 in the Queensland Geological Survey Collection.

Lygodium antiquorum, Shirley[114] is based on a small fragment. Shirley describes it as a tripartite lobule of a frond surrounded by characteristic plaited sori. It seems to me that this small specimen is simply the terminal portion of a frond, and I can see no trace of the sori mentioned. It is such a fragmentary specimen that accurate specific or even generic determination is not possible.

Pecopteris cf. *Mantelli*, also described and figured by Shirley,[115] is such a small imperfect specimen that it cannot be assigned to definite species or genus with any degree of accuracy. The venation it exhibits is not as perfect as shown in Shirley's figure, and is rather more like *Cladophlebis* than *Pecopteris* ; the pinnules do not contract at the base as shown in the figure. (The description says the veins " run at angles of 45 to 60 degrees to the margins " ; the figure shows them at right angles.)

Two specimens are described and figured by Shirley as *Neuropteris punctata*.[116] It only needs a glance at the figures to show that the two are not the same. One of them is referred to above under *Danæopsis Hughesi*. The other is the top portion of a frond of the *Cladophlebis* type and is probably a slightly abnormal specimen of *C. australis*.

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[114] Shirley (98), p. 17, t. 17, fig. 3.

[115] Shirley (02), p. 11, t. 6.

[116] Shirley (98), p. 20, t. 14, fig. 2 ; (02), p. 11, t. 7.

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EXPLANATION OF PLATES.

Unless otherwise stated, figures are reproduced natural size.

PLATE 1.

1. *Stenopteris elongata* (Carruthers). Denmark Hill, Ipswich. *See* p. 40.

2. *Tæniopteris crassinervis* (Feistmantel). Wycarbah, near Rockhampton. *See* p. 39.

3. *Thinnfeldia Feistmanteli*, Johnston. Fertile frond. Denmark Hill, Ipswich. *See* p. 17.

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PLATE 2.

1. *Thinnfeldia Feistmanteli*, Johnston. Denmark Hill, Ipswich. Portion of fig. 2, natural size. *See* p. 17.

2. *Thinnfeldia Feistmanteli*, Johnston. Denmark Hill, Ipswich. ($\times \frac{4}{7}$). *See* p. 17.

1
2
(X 4/7)

PLATE 3.

1. *Thinnfeldia odontopteroides* (Morris). Campbell's Quarry, Albion. *See* p. 19.

2. *Dictyophyllum Davidi*, n.sp. Portion 28, parish Biarra, near Esk. *See* p. 10.

3. *Thinnfeldia lancifolia* (Morris). Fertile specimen. Denmark Hill, Ipswich. *See* p. 21.

4. *Thinnfeldia acuta*, n.sp. Petrie's Quarry, Albion. *See* p. 23.

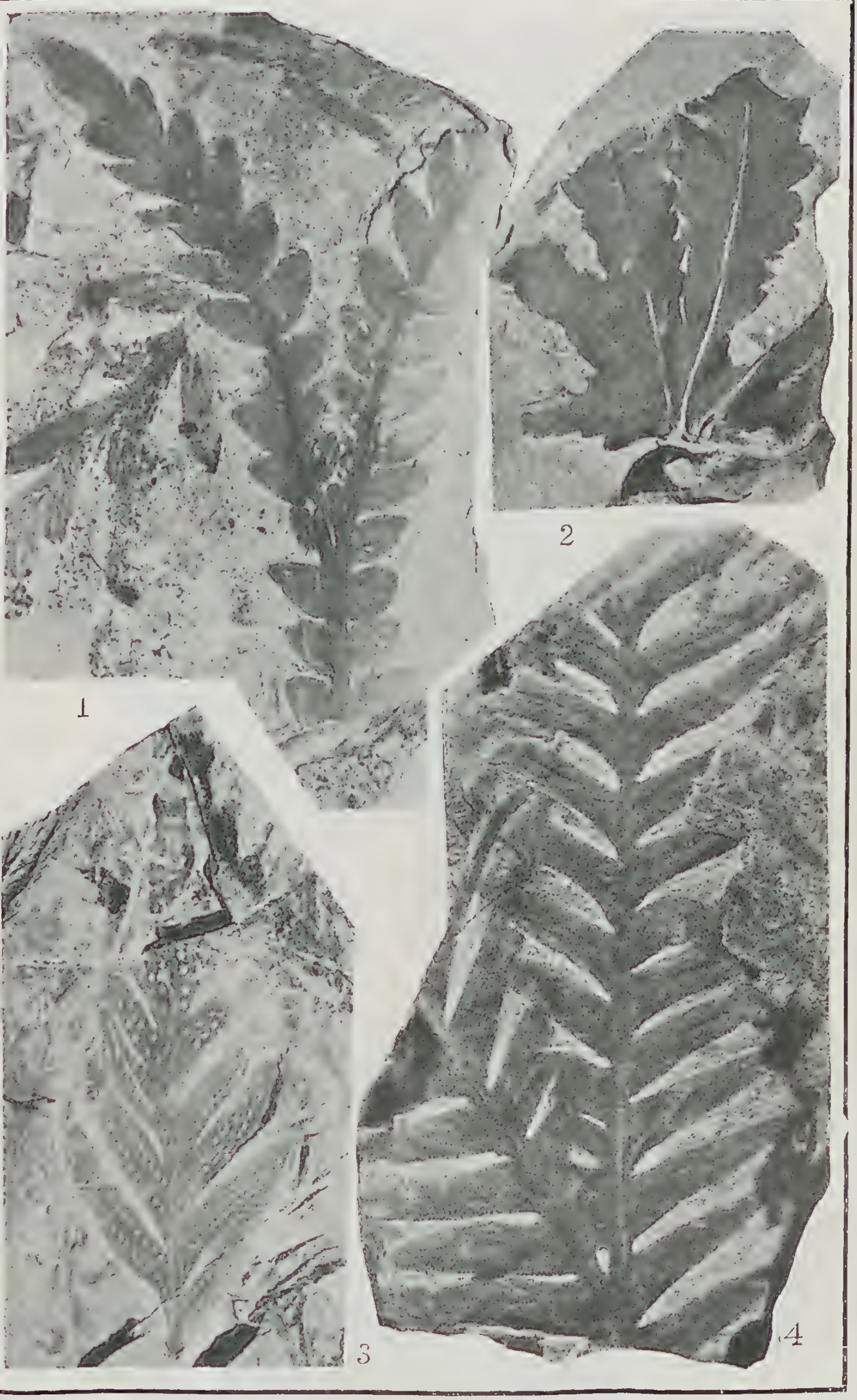
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PLATE 4.

1. *Thinnfeldia lancifolia* (Morris). Petrie's Quarry, Albion. *See* p. 21.

2. *Coniopteris delicatula* (Shirley). Fertile frond, and fragment of sterile. Shorncliffe, Sandgate. *See* p. 6.

3. *Dictyophyllum rugosum*, L. and H. Denmark Hill, Ipswich. *See* p. 9.

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2
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PLATE 5.

1. *Cladophlebis australis* (Morris). Yeronga. (× ⅘.) *See* p. 3.

2. a. *Cladophlebis australis* (Morris). Beaudesert. *See* p. 3.

   b. *Tæniopteris spatulata*, McClelland. Beaudesert. *See* p. 30

1
(x $\frac{4}{7}$)

2

PLATE 6.

1. *Stenopteris elongata* (Carruthers). Denmark Hill, Ipswich. *See* p. 40.
2. *Stenopteris elongata* (Carruthers). Denmark Hill, Ipswich. *See* p. 40.
3. *Stenopteris elongata* (Carruthers). Denmark Hill, Ipswich. *See* p. 40.
4. a. *Stenopteris elongata* (Carruthers). Denmark Hill, Ipswich. *See* p. 40.

   b. *Dictyophyllum rugosum*, L. and H. *See* p. 9.

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PLATE 7.

1. *Cladophlebis australis* (Morris). Denmark Hill, Ipswich. Mould of lower surface of fertile specimen. *See* p. 3.

2. *Thinnfeldia lancifolia* (Morris). Petrie's Quarry, Ipswich. *See* p. 21.

3. *Danæopsis Hughesi*, Feistmantel. Denmark Hill, Ipswich. *See* p. 24.

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PLATE 8.

1. *Cladophlebis australis* (Morris). Denmark Hill, Ipswich. Lower surface of fertile frond. *See* p. 3.

2. *Tæniopteris spatulata*, var. *major*, Seward. Stewart's Creek, Stanwell. *See* p. 32.

3. *Sphenopteris superba*, Shirley. Denmark Hill, Ipswich. *See* p. 27.

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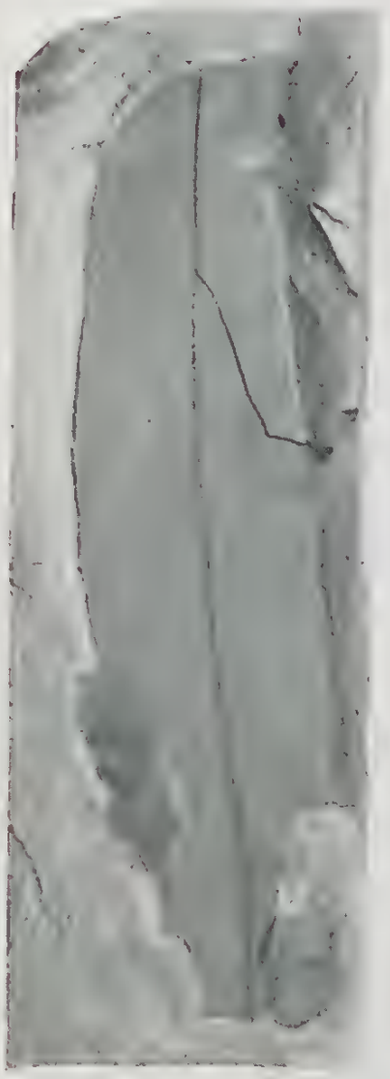
3

PLATE 9.

1. *Tæniopteris Dunstani*, n. sp. Denmark Hill, Ipswich. *See* p. 37.

2. *Phlebopteris alethopteroides*, Etheridge Jr. Fassifern. *See* p. 8.

3. *Dictyophyllum rugosum*, L. and H. Denmark Hill, Ipswich. Fertile specimen. ($\times \frac{2}{3}$.) *See* p. 9.



1

2

3
($\times \frac{9}{5}$)

PLATE 10.

1. *Phlebopteris alethopteroides*, Etheridge Jr. Fassifern. *See* p. 8.

2. *Coniopteris delicatula* (Shirley). Shorncliffe, Sandgate. *See* p. 6.

1

2

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181